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NATURAL ANALOGIES.

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In several articles on biological subjects published during the last fifteen years, I have called attention to the importance of analogical reasoning in the consideration of many scientific subjects.

To a limited extent this process of reasoning is carried on by scientific writers generally, but more with reference to its convenience than with a full realization of its great importance; for example, the vibratory theory is made use of by physicists in discussing heat, light, electricity, and sound, and most authors on the correlation of forces, and modern philosophers like Herbert Spencer endeavored to reduce universal phenomena to simple terms such as the convertibility of matter and motion, but from first to last all these thinkers seem to have missed what appears to me to be the most valuable application of analogy to practical sciences.

It does not require much thought to concede that a house built of bricks will possess the properties inherent in individual bricks, such as uninflammability, degrees of porosity, impermeability to moisture and air, and even the colors of the original brick, but it has taken thousands of years to establish the fact that however highly differentiated the animal tissues may be they possess only attributes of the primitive cell, some having one or more abilities highly developed with others in abeyance.

Thus the protozoon eats, grows, reproduces; so does the man, and for the same reasons. Whether we regard the processes as homologous or analogous, these acts performed by every animal have their foundation in the ability of the primitive cell to do the same things. It requires a certain familiarity with zoology and physiology to be capable of appreciating this connection, and it is a hopeless undertaking to try to teach such conceptions to those who are not furnished with the necessary preliminary knowledge. And there are those who are instructed in such matters, who for the want of sufficient deductive ability are unable to see the dependence of the phenomena because to their untrained minds the complicated processes of ingestion, such as deglutition, insalivation, mastication, digestion, etc., apparently differ so radically from the simple assimilative act of the amœba.

The ends attained are identical, though the processes may differ, somewhat as the sun-dial, the hour-glass and the clepsydra differ from the modern watch. No matter how complex the organism, the individual cells that compose it absorb food directly, very much the same as do primitive single-celled animals.

The complicated differentiations, to those unfamiliar with the subject, differ radically from their origin, as Talmage imagines he differs from the ancestral ape.

That analogies have been considered useful in some ways is shown by many attempts to utilize them, as, for example, in the celebrated work of Bishop Butler, whose success in the application Huxley thinks was not very great, for the latter claimed that the story of Jack and the Bean-stalk could be proven by the same method of reasoning. The sloppy manner in which analogies have been selected to illustrate certain points show that while there was acknowledgment of their value there is universal ignorance of their real nature.

I firmly believe that there will eventually be elaborated a science of analogies which will bear a relationship to the imperfect usage of the past in such matters that the old bears to the present zoology and botany.

Spencer makes good use of the method in an essay on "The Social Organism," and pretty generally throughout his works, but I think that neither he nor any other author touches upon the special point which I shall endeavor to make clear in this article.

Superficial resemblances often betray writers into incorrect use of metaphor, figures, or simile, either of which is upon close inspection nothing but a rhetorical admission that analogy has its uses. But its abuses are all too numerous, particularly in attempts at allegory and the puerile fable.

Superstition arises from an imperfect observation of natural phenomena which science dispels by the growth of intelligence with more accuracy of observation; as alchemy and astrology were followed by chemistry and astronomy, so mythology, which is the savage attempt to explain the universe through crude conceptions, is gradually being superceded by philosophic recognition of the unity of the laws governing everything.

One of Lord Bacon's essays is devoted to an ingenious attempt at explaining ancient Greek and Roman mythologies as symbolizing profound wisdom, and no legend among them was too silly not to be reconciled on this basis. The confusingly complex ecclesiastical symbolization is the outgrowth of endeavors to find material equivalents for spiritual things, with such poor success that the Christian can see nothing holy in the crescent and horse-tail of the Mohammedan, while the latter derides the cross as "two sticks," and exclaims "Behold the Christian's God."

And now we come to the main consideration. It is nothing new that there are parallelisms between the acts of men and nations, but these connections were treated of as purely accidental, or at best as if they were caused by some inscrutable law. I am not aware that anyone has preceded me in announcing that so far from there being anything mysterious in such matters the interdependence of phenomena and the possibility of reducing all things, if not to their ultimates, at least to simpler terms, enables many of the operations of the universe to be better understood and simplifies them astonishingly.

But first of all to enable this insight, the scales of ignorance must be scraped from the eyes, for the past system of education that ignored the sciences would create this blindness. Sociological study depends upon a knowledge of biology in its widest sense, comprising such things as anthropology, ethnology, zoology, botany, comparative anatomy and comparative physiology, and the front door to all this knowledge is chemistry and physics.

It may not be possible for any one person to master all these branches in their entirety, and we daily encounter narrow specialists in scientific fields, who, for want of education, cannot see the bearing of all the departments of information upon their particular branch. Such are anatomists who know no botany or chemistry; botanists who know nothing outside of plants; chemists who can see nothing beyond their test tubes and reagents. But, other things being equal, no one is so well equipped to *begin* the study of the universe as is the one with a good training in chemistry.

During the great fire of Chicago it was observed that the marble fronts of the houses seemed to melt in the flames and that the bricks were the really fire-proof material, facts which did not surprise the mineralogist, who, with his chemical knowledge, knows that carbonate of lime readily calcines and that silicates resist heat.

Comparably the philosophical scientist can reason from cause to effect, or backward, intelligently, and see associations that do not exist for the one with purely classical knowledge. A house may be an aggregation of bricks, stone, or wood, and will behave toward fire, water, and air as its component materials enable it, without surprise to anyone, but when communities are made up of human beings the old-time historian never traces relationship in the behavior of one to that of the other. The whole had no relation to its parts.

Even among sociologists who recognize these dependencies, a deeper source of information was seldom sought, such as biology in general, and they might indulge in the general smile of contemptous ignorance if it were hinted that chemistry and physics could aid their research.

To illustrate that analogies have a deeper significance than is usually assigned them, let us take the instance of what has been called a "bread riot." People are starving; they are turbulent, rushing here and there, finally gathering at some warehouse where food is stored, which is soon scramblingly distributed and eaten. This proceeding on the part of the populace is instigated by analogous and in many respects identical conditions existing in each individual of the mob. The collection of cells composing each person are in revolt; they are badly nourished; the intestines, muscles, nerves and their cells are hungry; the blood corpuscles surge through the vessels irregularly and riotously. The white blood corpuscles particularly are more active than usual, exactly as the free amœba moves more rapidly when hungry than when fed. There is starvation excitement throughout the body. The lymph and vascular channels are ransacked for food, and what previously would have been rejected is now assimilated exactly as the starving rabble gather offal from the streets and alleys. The fat repositories are drawn upon with resulting emaciation; the cellular elements are enfeebled, and multitudes of them die, as occurs among the starving populace.

A single cell may become a source of irritation to the colony of cells by provoking action, and individuals seek to impress themselves upon a community by orating, sermonizing, lecturing, quarreling, fighting; all more or less ignorantly are seeking gain.

A modicum of such excitement may result in benefit to the colony of cells, as an individual's action may result in the common good. Great national activity may eventuate in benefit to the world. In all these cases the good done may be accidentally accomplished. An epidemic of insanity may become as wide-spread as during the crusades, as crazy physiological processes may be induced by a fever.

Metzchnikoff's description of phagocytosis, interestingly reviewed by J. L. Kellogg in THE AMERICAN NATURALIST, June, 1891, quotes Osler's summation as follows: "He says that Metzchnikoff has likened specific inflammation to a warfare in which the invading forces are represented by micro-

organisms, and those who offer resistance by leucocytes. The news of the arrival of the enemy is telegraphed to headquarters by the vaso-motor nerves, and the blood-vessels are used as an avenue of communication with the threatened region. When the invaders are established they live on the host and scatter injurious substances which they have formed. The active leucocytes make an attack and try to eat the micro-organisms, and some die in the fight. Their dead bodies form an accumulation of pus, and when many are slain the battle-ground is known as an abscess. The hostile force may be overcome resulting in the recovery of an animal, and if not, in its sickness or death. In our bodies, then, there is a standing army of moveable cells, which may be equally concentrated and attack any force which may appear."

Now let us see what chemistry will afford in further explanation. In plethora the cell is quiet. When sufficiently nourished it performs its functions calmly and deliberately; its basic substance, the living protoplasm, was defined by Hoppe-Seyler as consisting of anhydrous nitrogenous hydrocarbon molecules capable of motion in a hydrated medium; the dead protoplasm resulted from the hydration of these molecules; the assimilative, reproductive abilities of the cell depended upon this molecular life, while this compound molecule existed intact and was able to construct, develop and differentiate similar molecules out of the less complex by chemical affinity. The molecule lived and was part of the cell, which was part of the man, which was part of the mob.

In a condition of surfeit no one would deny that a molecule was comparatively idle, but during privation its tension is necessarily increased, and there is danger of its breaking down into its component elements or forming lower compounds.

Other sociological relationships may be traced, and in a loose way the human organism has been likened to a monarchy. In a series of articles entitled "Monistic Mental Science," published in the "Open Court," 1887, I took the ground that the ideal, highest man was a republic; that the association of cells throughout his body cohered and worked, or should do so, in health, for the common good of the organism; that the ner-

vous system, including the brain, related the parts intelligently to conserve life purposes. The nervous system governs the body, but it receives its power to do so from the aggregated cells, and in this sense is a republic, and proper consideration of analogies will eventually work out clear conceptions of the social organism. It is the common idea that kings, parliaments, presidents, legislatures, congress, constitute the brains of society, when in reality they are one and all intestinal ganglia.

The Chinese locate intelligence in the abdomen, and the European, without being aware of it, mistakes abdominal for intellectual processes, and here is an instance where a better appreciation of things in general can be arrived at analogically. The real brains of a community consist of (it would seem trite to say) those who think, particularly those who think for the common weal; the philosopher, the scientist, the investigator stand in the front rank as brains; even the inventing mechanic should have high rank, and all such thinkers, in spite of the fact that they are not so recognized popularly. Heretofore, and to a great extent to-day, the real brains of a community are neglected, starved. In times of dearth they are the first to suffer, just as the reasoning power abates in sickness, and emotionalism develops.

In this and other respects a clarifying of our conceptions must occur before natural analogies shall be recognized as capable of being erected into a science. At present in this respect we are in a blundering, forming stage. Superficial resemblances for the most part have been used in analogy, and its profundity and capacity for exactitude have not been seen. One consideration alone baffled the carrying out of analogies, and that is, that in comparing an organism to a nation, it was considered necessary to make use only of living material, when in reality living material coheres with the inorganic, or what is called the "formed or dead material" of Beale. In the functions of the body there is use for such parts as the bones, just as machinery of all kinds, the telegraph, etc., are essential parts of a social organism.

The cells of the body are used up, die, or are cast off, but the man lives on. The individuals of a city perish here and there and are buried, until in a few generations there is an entirely new population, but the city, more or less changed, still exists. The molecular interchange of the cells is identical with this, and while so far as time and general processes are concerned there are differences, the operations of the nation depend upon the organism function, this upon the cellular, and the cellular upon the molecular. Nor are the activities so radically changed as we might imagine. The whole end and aim, physically speaking, is the conversion of molecular into mass motion, death reversing the process. The molecular life may be less than a minute; the cell life duration cover a few days or longer time; man may live nearly a century; the nation ten times as long or longer, but disintegration in some form or other overtakes them all, and history has to be studied in a new light to determine when the death took place.

The hermit crab is not the builder of the shell he lives in. Egypt will some day be wholly occupied by Europeans, and so in regarding the life of a city we may mistake the persistence of a shell and overlook the fact that the social organism which constituted the real city may have long since passed away.

Sociologically, merchants, bankers, etc., are the nation's intestinal or other visceral cells, and that they do not eat up everything that passes into their custody is solely due to their not being able to do so.

Common carriers may be the blood-vessels.

Telegraphs and other such means of communication constitute the nervous system.

Laborers, soldiers, are the muscle cells.

So-called rulers and law-makers (whether in republic or monarchy), merely obtain their power from the general units, and serve to correlate the intestinal and vascular operations as the sympathetic system does.

The professors, authors, and other real thinkers generally afford the unrecognized brains of communities, however starved and neglected; and, as individuals are usually guided emo-

tionally and think afterward, so the real brains of a community are disregarded in the main.

Pathological conditions infest communities as well as individuals, from want of harmonious working of parts. When the elaborating, transferring apparatus of a person or nation, as the intestines and blood vessels, or merchants and railways, either separately or together, become too selfish, and want to absorb everything, it is an easy matter to induce the intestinal ganglia legislature to adjust means for so doing; but, as this means death to the organism in general, a feverish condition may follow that threatens the national life until an equilibrium is restored. The intestines are often traitors to the commonwealth, but so may be other associated parts.

The workings of the nervous system, especially that of the spinal cord with its gray centre and white columns, may be explained some day by an application of electrical laws, particularly when the latter shall be better understood. New principles are yearly being worked out in this realm. Carefully applied reasoning may enable *an explanation of physiological mysteries* that cannot be possibly arrived at any other way. Many of the viscera are not so well understood as they should be. The functions of the spleen, liver, and pancreas, while much better known than formerly, are still to a large extent "sub judice." Analogies may enable us to better understand these parts, and in turn a better understanding may be reflected upon sociological and other matters.

In the American Journal of Psychology, Jan. 1890, the following comment occurs on the discussion between Weismann and Gotte (*über die Dauer des Lebens, und der Ursprung des Todes.*) "We may illustrate Gotte's idea by an analogy. Essentially there is no difference in the idea of death as applied to biology and as applied to the death of a literary society when the members agree to disband, possibly to found new societies. If we could feel sure that the analogy is sometimes more than a mere analogy, but at bottom is a universal principle of life, we could gain immensely by the mutual comparison between sociology and biology. There are many terms and ideas common to the two sciences, such as division

of labor, development, atavism, colony, etc. Reproduction by self-division might be illustrated by a splitting of the tribe into two. Budding, by the founding of a colony by emigration of individuals representing different trades needed in the new colony. Sexual reproduction, by emigration of a single couple, and the gradual development (embryology) of the colony with differentiation of labor as the individuals increase in number. The individual in this illustration represents the gemmule. The integrity of a state does not depend upon the number of persons, though the amount of its activity and wealth does. Similarly in the cell, the gemmules may be of like nature, and vary much in number. Here the illustration favors the view of Kolliker rather than Weismann.

"Although the work of two persons may be different, they are essentially alike in characteristics, and the descendants of any person in a state could found a similar state if forced to do so by emigration."

The same journal in the connection of criminology, suggests that "the whole study of pathological humanity may do for humanity what pathology has done for medicine."

Analogy (which is often identity) may be used to illustrate psychological processes. For example, the individual thinks pretty much as the social organism does. Seldom is a community wholly guided by superior thought. Its mercantile, transportation, and intercommunicating machinery is hard at work on the victual and clothes question. Amusement comes next. If a subject such as popular reform, inebriety, education, comes up, any person with advanced views will be talked at and about, by silly vaporers, and his ideas will be contested; this or apathy may smother the measure, the organism goes blundering on, guided by average expediency.

Methods of rural village, town, and city workings are comparable to those of individuals with different degrees of wealth and intelligence. As in higher animal life there is better co-ordination and correlation of parts, so in the growth of a community there is a tendency to increased subordination to intelligence, for the higher grade intellects may eventually impress their ideas upon the commonwealth.

Sulphur, carbonate of lime, silicates, chloride of sodium, and other inorganic substances enter combined or uncombined into the composition of carapaces, shells, bones, serum of living animals, pretty much as telegraphs are integral parts of the social organism. Several years ago in a work entitled "Comparative Physiology and Psychology," I argued that primarily, some of our ancestral animals accidently picked up a nervous system, consisting of phosphatic granules, which became linearly arranged by action in the line of least resistance, forming axis cylinders which became encapsulated, precisely as do many foreign substances in the body.

Professor Cope advanced the doctrine of "Acceleration," by which is meant that every time an ontogenesis is reviewed, the characters appear at earlier and earlier periods, or in other words, the developmental history is compressed to give room for the later added requirements. Adapting this to national matters, the United States seems to be rapidly passing through stages which required ages, comparatively, in older nations.

Written languages tend to become phonetic in spelling; more rapidly in America where conservatism is not so strong as in England, less rapidly in France owing to euphony being paramount; in Spain, Portugal, and Italy, it has been accomplished for many decades, radically in the last named country; in Germany there would seem to be little to be accomplished in this direction, but in the last twenty years the silent letter "h" may be omitted. Conservatism holds on to unpronounced, absolutely useless letters under various pleas and biases. How very like this is to the unfaithful copying of ontogenesis by phylogenesis. The abridgment occurs in the interest of the individual and the race, with here and there fossilizing tendencies against alteration.

The rapidity with which phonetic spelling advances in America indicates that Cope's law of acceleration is at work to develop the United States in this as in other regards beyond the capabilities of its senile parentage. Many other useful innovations are similarly made and meet with resistance. And yet without conservatism there would be no advance, for,

in general, resistance to the new until its utility is demonstrated, prevents the adoption of many vagaries.

In past generations, boys up to fourteen and sixteen years of age were greatly influenced by dime novel, Indian and pirate tales. No matter what the cause may be (probably the dissemination of better reading matter), it is the boy of ten years, or younger, nowadays, who affects such reading, and this may be likened to a condition existing in the days of knight errantry, when cock and bull stories of fights with dragons and giants were rife among every class of adults. Bombastic and emotional influences for centuries back existed generally among all, and more recently the Capt. Marryat style of novel lured young men to become sailors, and in some instances, pirates.

As the individual repeats in his life-time the history of the world, so to speak, he must pass through the stages of puerile belligerency, until he profits by his own experience, or that of others, and a boy of to-day, by the law of acceleration, passes more rapidly through these periods than did the one of a generation ago; and going back we find a period when a lifetime was required to outgrow this disposition.

Friends fall away during misfortune and are attracted to wealth and power, in obedience to laws which are identical with those that create parasites among plants and animals and the so-called messmates of the latter: the attraction of single and multiple celled organisms to food; and all these find their fundamental causes in laws of chemical attraction and repulsion of atoms.

Increase in chemical and mechanical motions often induce atomic interchange and molecular motion and recombination; as for instance, stirring a compound to produce precipitation or crystallization, changing the temperature of re-agents to produce a reaction, heating a battery to increase electrical generation, and so massage or bodily irritation draws blood to a part and stimulates physiological processes.

The stirring up of individuals by excitement increases the working capacity, and communities are similarly affected by causal relationship in these matters. If a nation is impelled

to greater activity through mental influences, it is because the molecular makeup of many of the individuals composing the nation is in a state of changed activity.

Without the atoms there would be no cells; without the cells no man; without the man, no nation; and activities among either affect all of them. For many years as a student of diseased mental processes, I have often satisfactorily combated such things as delusions of persecution, morbid fears, apprehensions, and fright, particularly in incipient insanity, by an application of the following reasoning:

In a healthy state, a fright produces certain sensory and motor phenomena in the body, such as rapidity of heart action, capillary dilatation and contraction, temporary muscular paralysis, and in extreme cases, perspiration and loss of sphincter control. Now as these are the usual expressions of fright, it is plain as anything can be that if disease may so interfere with the nerve mechanism as to produce any or all of these associated effects, it would be natural for the mind to interpret them as being due to the usual cause. For example, fear may make the heart beat fast. I have known an organic disease that interfered with the pneumogastric branches at the base of the brain, or with the cardiac sympathetic nerves running from in front of the spinal column to set up irregular heart action, and a feeling of dread or apprehension, or even terror will be thus caused by association, unless some compensating influence, which is not usual, interferes.

By artificial regulation of the heart's action, both the physical and mental disturbances may be caused to cease. Evidently a fright stimulates the heart muscle to greater activity, necessarily causing greater commotion among its cellular molecules, and the reverse condition is also true. The molecular action of the heart muscle may produce fright.

I would divide analogies into two particular classes, the apparent, and the real. The fact that as we advance in knowledge, resemblances in the mode of operation of widely unlike phenomena are being more clearly seen, and that even by the lowest races, resemblances are more or less accurately traced, justify the prediction that some of our greatest revela-

tions of the universal workings will be obtained through a scientific study of analogies.

The apparent analogy may be taken as tentative, or it may be wholly false, or merely poetical, such as is afforded us by the allegories and mythologies, and even scientific writers may find a use for an apparent analogy in illustrating certain matters.

The real analogy is such by direct interdependence and relationship, and the great difficulty in determining its reality lies in the necessity for the accurate understanding of these relationships.

It is not possible for any one human mind to be thoroughly versed in chemistry, physics, biology, psychology, geology, and astronomy, and for this reason the one who may be familiar with one or two branches and have a fair knowledge of the rest, will be able only to generalize, but his suggestions could be heard and amended by a worker in complementary fields, and eventually a synthetic study can be erected, unifying what is known in these various departments, and thus astronomy may come to explain a problem in microscopy; biology may clear up a chemical point; and sociology, in the light of the other sciences, may explain an otherwise inscrutable physiological matter.

Necessarily the history of the past may thus be laid bare, and ethology may become a science such as David Hume little dreamed of. The reasons for behavior, the feelings, passions, vices, and virtues, may thus be seen. It will be found that we are truly creatures of circumstance.

The significance of institutions may be more easily understood in their relation to the commonwealth. We may be better able to determine whether a measure will be useful or harmful, for example, when we make comparisons of certain physiological processes with sociological ones, there may arise a necessity for assigning a certain contemplated national movement to its proper place in the general economy. These comparisons may enable us to prove that instead of being a newly evolved useful structure, it may be in the nature of a cancer or an ulcer hostile to the national life.

Plato's model republic was founded upon vague correspondences between mental and social divisions. Under Reason, Will, and Passion, he placed counsellors, the military and the people, and Hobbes pictured the State as a monster "Leviathan." Herbert Spencer deserves full credit for formulating many analogies in the light of biology, and in the essay on "Social Organism" lays down parallelisms and leading differences well worth studying. Some of which are as follows:

The differentiation of labor is universal in all kinds of development.

Among primitive people the ruling class is comparable to the ectoderm, the governed to the entoderm, and when with later evolution the trading class was created, then the mesoderm arose, which furnished the distributing avenues. This may be taken to represent Europe in the feudal period.

Great activities in society may abstract capital in one direction at the expense of another, just as over cerebral excitememt may draw blood from the abdomen and cause indigestion. In the lowest animals there exists no blood. Among aborigines there is no circulating medium.

Circulating methods and channels increase in complexity in the ascending scales of animal and national evolution.

The growth of a consolidated kingdom out of petty baronies is like an advance among the species of Articulata. Closer commercial and governmental unions between the several segments subordinated to a cephalic ganglion.

England of to-day, Spencer would compare to some much lower vertebrate form than the human.

Parliaments discharge functions that are comparable to those discharged by the cerebral masses in a vertebrate, he says in the essay, but he refused a seat in parliament, as he denied that it was any place for a high order of thought, stating that that body did not govern or make laws, but merely promulgated what was indicated to it by extrinsic (mainly popular) influences. And in this idea of the legislative and executive being the cerebral and cerebellar parts lies a great field for discussion.

My view is that scarcely any nation has much more than passed the invertebrate stage. At least all are pretty low in the Simian scale, if as far advanced as that. Some may be likened to ferocious gorillas, brutal baboons, capering lemurs. The highest are scarcely as thoughtful as the chimpanzee.

But seriously, the Science of Analogies, merits very deep consideration as promising revelations obtainable in no other way in chemistry, physiology, biology, sociology, in all their ramifications. The orbits of the planets have been with reason found analogous to molecular rotations and between the atom and the star lie universal principles applicable to a better understanding of mental and physical laws of animals and society. History will by its means be read in a new and brilliant light, and the ideal nation may possibly be evolved from the better understanding of what would constitute one.

THE TWO SCHOOLS OF PLANT PHYSIOLOGY AS AT PRESENT EXISTING IN GERMANY AND ENGLAND.[1]

By E. L. Gregory.

It is an admitted fact that the science of vegetable physiology has reached a stage of development in the different scientific schools of Europe in advance even of the same department of animal life. It is also well-known that in Germany the three most prominent men who have contributed to this result are Naegeli, Sachs and Schwendener.

The expression "Two Schools of Plant Physiology" is one, however, which requires some explanation, and possibly, defense. It implies that the various conflicting theories which are at present occupying the botanical world may be traced back to two distinct sources, which, if true, is a fact not so universally known or admitted.

All scientific students whose knowledge of botany extends as far as a mere superficial acquaintance with the ordinary text books, are more or less familiar with the position occupied by Sachs. His text book may be said to be the first general text book on the science of the plant kingdom; that is, the first reckoning from that time when our knowledge of the phenomena occurring in this kingdom and of the laws governing them was considered sufficient to warrant the expression "Science of the vegetable kingdom." The various text books of general botany written before this time are now considered of little worth except as historical records. It is partly owing to this fact of priority that all our later text books bear so strongly the impress of Sachs' personal teaching. His name is constantly repeated in connection with the principles which he advocates, whether these principles owe their discovery to him or his predecessors. It is, therefore, impossible to read any of the ordinary text books without becoming somewhat familiar with the ideas and theories advocated by Sachs.

[1]Read before the meeting of the American Society of Naturalists, Phila., Dec. 29, 1891.

It is, however, quite different in the case of the works of the two others, Naegeli and Schwendener; especially is this true of the first named, whose long and busy life presents a record of intellectual labor and achievement possibly unequaled and probably unsurpassed by any other scientist of the present generation. He was a teacher, like the other two, and not only retained his position as professor of botany in the University of Munich, but fulfilled all its duties up to the day preceding his death. Unlike the other two, he seemed to lack in some degree that quality of mind usually so predominant in teachers, namely, the necessity of impressing its mode of thought on other minds. He was a sharp, keen, and logical thinker, and directed his strongest efforts in search of unknown truths. Although he may not in any sense be considered the founder of a school, it would be impossible to discuss fairly the present condition of this science without referring to the influence of his thought and labor.

The object, therefore, of the following paper is to consider briefly the present condition of plant physiology as it now stands in Germany and England, represented as under the controlling influence of two men, Sachs and Schwendener. A paper claiming such an object must necessarily contain much that is personal in character; it may, therefore, be allowed the writer to disclaim, at the outset, all design of personal defense or attack, whatever the appearance may be, the purpose being to show, as clearly as possible in such brief limits, the principal features presented by the teachings of two men whose methods and theories are in some respects antagonistic.

Again, in farther explanation of this purpose, as before intimated, the teachings of Sachs have become familiar through the works and text books of his numerous students and disciples. It is, perhaps, quite safe to say there is not a single text book on plant physiology which in all its important features is not based on the principles expressed and advocated by Sachs.

On the other hand, it is equally true that if there is a school of scientists opposed to many of these theories it has not yet reached the position to lay claim to this title by the publica-

tion of text books. In short, this school is of a date so recent that comparatively few of its theories are accessible to the English-speaking world. As an illustration of this fact, one of the most strongly contested points of disagreement between Sachs and Schwendener is in reference to the cause of twining stems. Vines in his text book of physiology gives the theory of Sachs and also those of various later writers, and among others refers briefly to that of Schwendener in these words: "Schwendener attributes the twining to circumnutation and to an antidromous torsion." Professor Schwendener said of this after reading it carefully, "This is quite erroneous; he has entirely misunderstood my theory. According to my explanation of this fact, torsion is only an effect of twining and not a cause."

In that department of plant physiology which deals with nutrition there are fewer differences of opinion than in that of the physiology of movement. It is in the latter field especially that Professor Schwendener has worked out solutions of various problems differing vitally from those of any other physiologists. In fact, his fondness for mechanical questions has given him the reputation of a specialist in the narrow sense of the term. Added to this is the fact that his discussions of several theories are so abstruse as to render them difficult even for the mature students who are likely to choose such studies in the German Universities. Thus, in speaking of his work on the position of leaves, he said it was extremely difficult for his advanced students who had been under his own training to follow his lectures on this subject; that with all his illustrations and models which he had constructed for these lectures it was often necessary for him to go twice through the same lecture, and that he never felt certain of the number who had conquered the subject until he had tested them in the laboratory.

Again referring to Vines, who may be considered at once the best exponent of the views of the English botanists and a fair disciple of Sachs, he says of this: "Schwendener has constructed an extremely simple theory regarding the position of leaves."

This implication of narrowness and specialization is, in the writer's opinion, extremely unjust and lacking foundation in truth. The fact that he chooses to devote special attention to the mechanical problems connected with the subject of growth by no means proves his unwillingness or inability to cope with all the questions connected with the subject, those referring to plant nutrition as well as those of growth. It is, however, unquestionably true that the habit of reasoning induced by studies of this nature is such as to lead to a different treatment of the questions of plant nutrition from that adopted by most of his cotemporaries.

For example, in all those questions included in the general term, "plant-metabolism," his views may be said to be strongly conservative when contrasted with those of the school of Sachs. Among the latter are many who express the hope of being able to trace the course of the changes connected with these processes in such a manner as to prove by actual weight and measurement the principle of conservation of energy. There are no text-books on plant physiology except, perhaps, a few elementary ones, in which the author does not run through some mode of reasoning either attempting to prove it, or show how it may possibly be proven. Starting with the process of CO_2 assimilation as it is called, an arbitrary equation is formed which may, or may not, show the changes undergone in this single process. The equation is purely arbitrary, no proof whatever can be given of its truth, except that it expresses how the relations might be adjusted. A much more difficult matter is undertaken by those who try to explain the process occurring in the changes caused by respiration. All the German text books, Sachs, Pfeffer, Weisner, Reinke, Detmer and others, all have tried to give some hypothesis which may explain the exact nature of the changes by which the rhythm of destructive and constructive metabolism is kept up in the living processes of the plant. The physicist and the chemist both are able to carry on their computations, weigh and measure to the smallest fraction and verify their theories by actual demonstration. So far the botanist has tried in vain to apply the weights and measures of Physics

and Chemistry to the results of action connected with the living portions of the plant. The difficulty lies not only in the extreme delicacy of the material in question but in the danger of interference with the processes as they go on.

Schwendener and his followers claim that we have not yet reached that point in the development of the science where such questions may be asked with a reasonable hope of a satisfactory reply. Our knowledge is too meagre and our means of acquiring more are as yet inadequate. In other words, they claim that the methods now used are incorrect, inasmuch as they do not aim at constructing a theory which shall satisfactorily account for certain facts, but they presuppose the existence of the facts, and the methods result, for the most part, in mere conjectures and speculations which count for nothing.

Whether this view be true or false it is unquestionably the source of the implication of narrowness and onesidedness before referred to, as obtaining against Schwendener among his own cotemporaries and his own country. Even here, however, it cannot be said that there is any actual difference in opinion between the two schools, only that the methods and results so far obtained by the one, are held in very light esteem by the other. It is very different when we come to the various problems connected with the growth and motion of plants. It is in this field particularly that the difference of opinion between the two men leads to positive difference in the teaching and modes of treatment of several important questions.

Schwendener gives, each year, a course of advanced lectures covering the following ten subjects.

1st. The mechanical principle in the development structure.
2nd. Theory of leaf position.
3rd. Mechanics of stomata.
4th. Bending of the medullary rays in eccentric secondary growth in thickness.
5th. Torsion, as caused by hygroscopical changes.
6th. Ascent of sap; hydro-mechanics of.
7th. Mechanics of twining.

8th. Nyctitropic movement of leaves.

9th. Mechanics of irritation movements.

10th. Flying apparatus of fruits and seeds.

All of these ten subjects he treats from his own standpoint, giving the results of his own experiments and study, except, perhaps, the last one, which is sometimes omitted for lack of time, and it is one to which he has given less attention than to the remaining nine.

From these ten subjects there may be selected three in which his opinions are diametrically opposed to those of Sachs and his followers; several of the rest are not treated at all in the latter school; and to the three here mentioned may be added two more important questions in which Schwendener differs radically from other physiologists. He gives the following list as including the most important questions of difference between his opinions and those of Sachs.

1. The problem of the ascent of water.
2. Cause of the year's ring.
3. Bending aside of the medullary rays by the rind pressure.
4. Mechanism of twining stems.
5. Turgor, its influence on growth of cell wall.

These may be said to represent fairly the important points which serve to separate the new school from the old. It is hoped a brief consideration of some portions will be sufficient to vindicate the right of the new school to this title, claimed for it here for the first time.

The problem of the water ascent is one in which Schwendener not only differs from Sachs but also from a large number of other botanists, who cannot be considered the followers of Sachs. The theory held by the latter and his school is, that the water rising in stems more than 30 feet high is for the most part carried through the lignified cell-walls. Schwendener and a large number of other botanists believe it is carried through the lumina of the cells. The difference, however, in the theory as taught by Schwendener and these other botanists, some of whom are, in other respects, his followers and adherents, is that they claim to give an exact explanation of the

manner in which this is done. On the other hand, Schwendener, who treats this question at length, denies our ability at the present condition of botanical knowledge to explain how the water is driven up. The agent he gives, but of the manner in which this agent works, he says we know nothing.

His treatment rests on a long series of experiments, the last of which were made several years ago and conducted as follows: A forester several miles out of Berlin was authorized by the government to allow the forest under his charge to be invaded for scientific purposes, and a small lodge was built where one of Schwendener's assistants remained for several weeks, in fact about eight weeks, so that the experiments might have an uninterrupted course, the professor going over every few days to perform the manipulations himself, while the assistant remained to watch and report the results.

(*To be continued*)

THE ZOOLOGY OF THE SNAKE PLAINS OF IDAHO.

By C. Hart Merriam.

The basin of the Snake River in Idaho is an undulating, sage-covered plain, stretching completely across the State in its widest part. It is crescentic in shape (with the convexity to the south) and measures about 600 kilometers (375 miles) in length by 120 to 160 kilometers (75 to 100 miles) in average breadth. Its boundaries on the north and east are everywhere sharply defined, consisting of rugged mountains rising more or less precipitously from the plain. In several places these mountains project southward in parallel ranges, like so many fingers, alternating with northward extensions of the plains, which occupy the valleys between them. Such valleys are those of Birch Creek and Lemhi River, Little Lost River, and Malade or Big Wood River. On the south and west the Snake Plains are not so well defined, passing southward into Utah and Nevada between irregular ranges of mountains, and westward and northwestward into Oregon and Washington, where they are continuous with the Malheur Plains and plains of the Columbia. The altitude of the basin along the course of Snake River is about 1,800 meters (nearly 6,000 feet) at the eastern end, and less than 900 meters (3,000 feet) at the western, and its sides rise on the north and south to the altitude of 2,000 or even 2,150 meters (approximately 6,500 to 7,000 feet), forming a broad trough whose general direction is east and west.

The dominant feature of the Snake River basin is sage plains—rolling, uninterrupted plains, rising so gradually from the bottom of the basin as to appear almost level, and stretching away in every direction as far as the eye can reach. The plains are everywhere arid. The few streams that reach Snake River by a surface course usually flow in lower channels and do not water the region on either side.

The surface rock which crops out here and there over the sage plains proper is dark basaltic lava. It appears in the form of irregular masses or beds, extensive lava flows, and in

a few instances of broken down craters, the largest of which, Big Butte, rises about 600 meters (2,000 feet) above the plain. Some of cañons of Big Butte support a growth of Douglas fir and Murray pine. The lava flows present great diversity of form; elevated ridges of rough rock irregularly fissured and with jagged edges alternate with smooth, flat domes, suggesting giant bubbles; nearly level stretches marked by wavelets and ripples which bend and double, spread out as if just escaped from a seething, tumultuous caldron, while in many places the thick crust has fallen in, leaving deep pits of circular or elliptical outline, exposing the mouths of dark caverns that extend to unknown depths and furnish homes to owls and bats and a multitude of nocturnal animals. This black lava or basalt overlies an earlier flow of porphyritic trachite, gray in color and much less firm in texture. The Great Shoshone Fall, commonly known as the "Niagara of the West," results from the cutting down of the river bed through the hard basalt to the softer trachite below.

In summer the heat is excessive, the thermometer frequently reaching 110° in the shade, while in winter the snow covers the ground, and icy winds sweep over the plain. The forms of life which inhabit the region, therefore are such as can endure great heat during the season of reproductive activity, and can avoid the cold of winter by migration or hibernation; or if they remain active throughout the year they are hardy species, able to withstand great extremes of temperature and humidity.

Most of the rivers which flow down through the mountain valleys disappear on reaching the plains, and the greater part of the water which reaches Snake River does so by subterranean channels. Hundreds of springs pour their waters into the lava cañons of Snake River, usually at or near the bottom, and many of them are of great size. In winter their temperature is considerably higher than that of the river. Crayfish, identified by Mr. Walter Faxon as *Astacus gambellii* Girard, abound in these warm springs and are much sought after by raccoons (*Procyon lotor?*) and a small shell, identified by Dr.

R. E. C. Stearns as *Fluminicola nuttalliana* Lea, is exceedingly abundant on stones in the same springs.

It is a common feature of the Snake Plains, as of many other arid parts of the West, that the rivers which do not sink cut for themselves deep channels with precipitous walls, their present beds being several hundred feet below the general surface level. Of this character are the grand lava cañons of Snake River itself and many of its tributaries, particularly on the south side. As a rule these cañons cannot be seen until their very brinks are reached, and it is not often that they can be crossed on horse-back.

The northern boundary of the Snake Plains is formed by the lofty mountains of central Idaho, and by that part of the main range of the Rocky Mountains which bends directly westward from the Yellowstone National Park. Three narrow parallel valleys penetrate the mountains of east-central Idaho in a northwesterly direction, carrying slender tongues of the sage plains all the way to Salmon River.

The soil of the Snake Plains, where not lava or sand, is generally alkaline, and the characteristic plants, in addition to the ever present sage (*Artemisia tridentata*), are such Sonoran species as *Atriplex confertifolia, Atriplex nuttallii, Artemisia pedatifida, Sarcobatus vermiculatus, Tetradymia canescens, Eurotia lanata, Eriogonum cernuum tenue,* several species of *Bigelovia,* a *Malvastrum,* and two or three kinds of cactus. *Artemisia trifida* and *Purshia tridentata* are common in the higher levels; and *Iva axillaris,* a saline species, was found at the sinks of Big Lost River.

The characteristic birds of the sage plains are sage sparrow (*Amphispiza belli nevadensis*), Brewer's sparrow (*Spizella breweri*), sage thrasher (*Oroscoptes montanus*), burrowing owl (*Speotyto cunicularia hypogœa*), sage hen (*Centrocercus urophasianus*), and sharp-tailed grouse (*Pediocætes phasianellus columbianus*), though the latter is rare in the area traversed. Ravens (*Corvus corax sinuatus*) and magpies (*Pica pica hudsonica*) are common in places, and the cañon wren (*Catherpes conspersus*) was found near Shoshone Falls in the lava cañon of Snake River.

The most common diurnal mammals are the Great Basin or sage chipmunk (*Tamias minimus pictus*) and a small spermophile (*Spermophilus townsendii*). Other equally characteristic species are the nocturnal kangaroo rat (*Dipodops ordii*), pocket mouse (*Perognathus olivaceus*), grasshopper mouse (*Onychomys leucogaster brevicaudus*). Four species of rabbits, namely, the white-tailed and the black-tailed jack rabbits (*Lepus campestris* and *L. texianus*), the Idaho pigmy rabbit (*L. idahoensis*) here described for the first time, and the great basin cotton-tail (*L. silvaticus nuttallii*) are common. Antelope roam over the plain in small herds, and badgers and coyotes are abundant. In the lava cañon of Snake River, near Shoshone Falls, the plateau lynx (*Lynx baileyi*), raccoon (*Procyon lotor?*), little striped skunk (*Spilogale saxatilis?*), dusky wood rat (*Neotoma cinerea occidentalis*), and cliff mouse (*Hesperomys crinitus* sp. nov.) are common, and tracks of porcupine (*Erethizon epixanthus*) were seen. Black-tailed deer (*Cariacus macrotis*) inhabit the cañons in winter.

Rattlesnakes (*Crotalus lucifer*), horned toads (*Phrynosoma douglasii*), and small lizards (*Sceloporus graciosus*) are common on the Snake Plains, and extend north through the principal sage-covered valleys. Two Bull snakes, provisionally referred to *Pityophis catenifer* by Dr. Stejneger, were collected at Big Butte and Arco, and a single *Bascanion vetustum* at Big Butte.

Salmon and sturgeon ascend Snake River to the Great Shoshone Falls. When we crossed the river at Lewis Ferry, October 15, we saw several large sturgeon (*Acipenser transmontanus*) tied by the tails to stakes driven in the bank. One weighed fully 70 kilograms (150 pounds), and we were told by Mr. Lewis that he sometimes catches individuals weighing as much as 300 kilograms (600 pounds). He told us also that a fall run of salmon reached his place about October 1, and that the fish that do not die go back in November. We met a number of Shoshone or Bannock Indians on their way to the river to spear salmon. Some of them came all the way from the Lemhi Reservation.

A kind of mole cricket locally known as the Idaho Devil (*Stenopelmatus fasciatus*) is common on the Snake Plains in

October. It is a large wingless insect with a great yellow head, powerful jaws, and a banded abdomen. I first saw it in eastern Idaho in October, 1872, and found it common from Shoshone Falls and Lewis Ferry to the head waters of Bruneau River in October, 1890. It lives in burrows in the sage plains and its holes resemble those of the small pocket mice (*Perognathus olivaceus*) in being clean cut, going straight down at first, and having no mound at the opening. In crossing the plains during cold stormy weather the heads of these curious animals were often seen at the mouths of their burrows and many were met with walking about among the sagebrush. They walk much, with seeming dignity and deliberation, and their tracks may be seen in every direction. If two are held together they immediately bite off one another's legs and inflict other serious wounds.—From *Animal Life.*

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RECENT LITERATURE.

Kuntze's Revisio Generum. II.—(*Continued from the February number, p.* 147.)—Section 10 discusses the difficulties arising from the almost simultaneous appearance of new publications, publications of uncertain date, incompleteness of libraries, etc.

Section 11 is entitled "Bentham and Hooker's Genera Plantarum and their neglect of the literature before Robert Brown." Kuntze is not the only one who has criticised Bentham for this, (G. J. Britten's Journal of Botany 1888, p. 261,) but Kuntze is especially severe upon him, not only for this, but for his method of changing species-names. He pays a high tribute to Bentham for his work in limiting and defining genera, but says (*in English*, § 16): "Surely Bentham was a genius of botanists, therefore I admire him, but he was a great sinner in nomenclature, who worked stupendously, but did not lose time in looking out for the rights of older authors and priority of their given names. He was a little ignorant of the authors of the past century; he took for instance.....Patrick Browne for ante-Linnean, although this botanist had adopted (1756) the Linnean system of 1735 with little alteration.....In the Genera Plantarum he has forgotten several thousands of generic names of Linnean and post Linnean time. He opposed the new international rule so as not to be obliged to correct himself innumerable times." Elsewhere he says, speaking of Bentham and Hooker: "Their nomenclature is to be censured not only because it is very incomplete as pointed out, but also because it builds wider upon the corrupt nomenclature of Robert Brown. The many inconsistencies and caprices in the choice of names in B.H.g.p. is to be deplored."

The truth of Kuntze's remarks will not be disputed. The English, as he says, admit it, but reply with the characteristic answer, "in our country we like to do so." So too, they like to measure with yards, feet and inches. Science is international or rather supernational, and it is not to be kept back by the prejudices of any nation. We may expect English botanists to cling to the methods of the "*raubritter*" period for a long time to come. But the world is not to be ruled by the heirs of Robert Brown.

The next section, 12, deals with the "*bequemlichkeit-motiv* as a hindrance to the restoration of rightful names." This "*bequemlichkeit-*

motiv" is the excuse constantly put forward by those who do not like to take all the consequences of the rule of priority. But like other vague principles its operation is somewhat capricious, and in practice is only applied where it suits the convenience of those who follow it. Bentham and Hooker, says Kuntze, follow it very inconsistently. In fact, he says, it is largely a patriotic motive, and they generally forget it in the case of their countryman Lindley. He gives some examples of Lindleyan names restored by them, and continues: "Lindley was one of the above mentioned companions of the Brown-Smithian clique which worked with Bentham on Wallich's catalogue 1829–31." He then speaks of the way in which authors in one country neglect foreign authors, and charges that the English and French "on the average overlook with great consistency everything written in the German language." Each nation too, "pushes to the front *nolens volens* its own authors," and he adds "we Germans are not entirely without this patriotic weakness." In these remarks he has struck the key note of the "*bequemlichkeit*" excuse. As he says, it is "directly opposed to the principle of order. If it is not given up, we shall revert to the condition before Linné, when each school or each land had a different nomenclature."

In section 13 he considers what should be the starting point for genus-names. He claims that there is no generally recognized *fixed* starting point. In general, Linné's last names are used together with those names given by his contemporaries which he adopted or did not rebaptize. But in some instances authors have gone back of his last names. Bentham and Hooker, he says, used the 1767 edition of Linné's *Systema*, not because they attached special value to that edition, but because they had no earlier one. Kuntze takes the editio princeps of Linné's Systema Natural (1735) as the starting point for genera, and explains his reasons at some length. In the first place he objects strongly to the citation of Tournefort for genera adopted from him by Linné. If Tournefort is cited, he says, why not Rivinus? And why not cite the authors between Tournefort and Linné whose names the latter adopted? It is, he says, making too great a leap to start with Tournefort, and then pass over all intermediate authors and start again with Linné. Some fixed point must be had and everything beyond rigidly excluded, or there will be no fixity in nomenclature. The citation of Tournefort arises, he says, from pietism and a little French patriotism. "Tournefort was shoved forward by De Candolle,.....but De Candolle and his followers ought first to have troubled themselves about the generally neglected contemporaries of

Linné, and have it yet to do before they make so long a leap backward."

The remainder of his argument is, in effect, as follows: The genus-nomenclature before Linné was very crude. Barbarous vernacular names, double names, as Barba-Jovis, etc., names in *opsis, pseudo*, etc. abounded to an intolerable extent. In his Flora Lapponica, Linné outlined to some extent, but only to some extent, the system and reform which he introduced in his *Systema Naturæ* of 1735. After 1735 the changes which Linné made in genus-nomenclature were for the most part capricious and made to confound or punish his contemporaries. It cannot be said that any of his works has been taken as the starting point. He made many changes for various reasons during his life, and his pupils and editors took his latest changes and handed them down, though some of them have not been followed. The foundation of modern genus nomenclature was permanently laid in 1735. All changes thereafter were in the details only. For these reasons Kuntze claims that this edition is the "only one which has a rightful claim to be the starting point." "There is," he says, "no rightful or moral ground for pushing aside the first and fundamental work of Linné." Accordingly he lays down two rules:

"1. Linné's *Systema Naturæ, editio prima princeps*, 1735, stands as the first consistently carried out Linnean system of nomenclature and system of genera; the work of 1753 for the first consistently carried out Linnean nomenclature for species."

As there is some doubt as to the exact time of the year at which the work of 1735 appeared, he adds: "2. In order to have an undoubtedly firm basis and a certain point of time for the beginning of our nomenclature, I have cut out from competition all the publications of other authors appearing in 1735 and bearing 1735 on the title page, and have allowed it (the competition) to begin first with the end of 1735—beginning of 1736, on the foundation of Linné's *Systema* I."

Admitting that there is no "moral" ground for pushing aside the edition of 1735, it remains to be seen how far there may not be practical grounds for so doing. This question he does not sufficiently consider. Many of Linné's later names, whatever motive may have led to their introduction, are great improvements upon his earlier ones. His last names have become firmly established, and there are good reasons for tolerating in him, the founder of nomenclature, some things which we need not countenance in his successors. We can take Linné's last names for the purpose of getting a fixed and permanent nomenclature without committing ourselves to submission to the

yoke of Robert Brown and his successors. But if authors go back to Linné's last names at all, there should be some fixed point beyond which they are not to go, and at which citation should stop. The adoption of the 1735 edition does not require as large a number of changes as one would suppose—indeed the number is relatively very small, and it certainly has the advantage of furnishing a certain, unmistakable and eminently logical foundation for nomenclature.

Section 14 is devoted to a number of proposed additions and amendments to the international rules, which make them more strict and definite, and modify some of them in accordance with his views as explained in the preceding sections. They are of such length, that but a few can be noticed here.

He proposes to amend article 51 by striking out the words "higher or" and adding at the end of the article "on elevation of a group, the author who founded the group should be cited, either alone with a § mark preceding, or with the other author behind in the second position." The last is of course to avoid what he calls "seduction." His object in making the change is to get a citation that will indicate clearly the origin of the name, so that there can be no doubt as to its validity against intermediate names. But he makes a distinction between the elevation and the reduction of a group, claiming that his rule should apply to the former only, and that in the latter case the correction only should be cited, and he argues this at some length. His reason is that to extend the rule to both cases would encourage undue haste and radicalism. So on the other hand, it may be said that his restricted rule put a premium upon undue conservatism, which sometimes does not demand much deliberation. His idea seems to be that a writer should feel that he describes species under new genera at his peril. It is somewhat inconsistent with his principles to allow any possibility of confusion for the purpose of chastizing genus-mongers; and it cannot be denied that intermediate names must be guarded against as much in one case as in the other. Throughout the book he is conspicuously hostile to genus-division. In this instance he seems to have carried his zeal too far.

In article 60 he proposes to strike out paragraphs 3 and 4, which he adds to article 28, and to substitute 11 paragraphs giving forms to be rejected. Of these 10 is "double genus-names," with three exceptions however, of which (b) is "personal names put together which result in a flowing word." This is not exactly consistent. How much worse are double genus-names than "flowing words" (!) like "Sirhookera," "Hallowmullera", etc?

His eleventh paragraph is: "In case of halves of separable ancient genus-names, if the first word is valid and capable of standing alone, and is not the name of a higher group, then the first word stands. Accordingly he gives us "Bursa" for Capsella, and our common weed he writes "*Bursa pastoris* Wigg."

To article 66 he adds: "Names which rest upon unlike orthography or are only to be distinguished by the presence or addition of final syllables, only stand as different words when they differ in one unlike *consonant* standing between two vowels or lacking in one of the words." He then proposes an addition to the effect that vernacular names and the younger of two pseudo-homonymes (e. g. Apium L and Apios Moench., within his rule) be adopted and Latinized or altered, as the case may be, by the addition of two or three letters; e. g. Vochy Aubl. he makes "Vochysia Aubl. corr. O. K.;" Apios, "Apiosus Haller corr. O. K." He lays down some more exceptions and additions, which are quite strictly formulated, and finally proposes this: "Permissible name corrections do not warrant the citation of the correcting author in the first place, either for genera or for the names of species to be joined therewith." He also lays it down that names like Heurckia and Vanheurckia, Candollea and Decandollea must stand as distinct. I believe I am justified in saying, however, that Saccardia (or as he writes it Saccardoa) and Pasaccardoa or Marckia and Lamarckia (both of which stand under his rule) are much more likely to be confused in practice than Apios and Apium, certainly more so than Capnodes and Capnodium, which conflict under his rule, so that he rejects the latter. Besides his "corrections" (as Apiosus) are fatal to the meaning of a name, and as a rule add nothing to its sound. It is all very well to have strict rules here as elsewhere, but there is room in this place for the application of a little common sense.

A suggestion which he makes for a new article is interesting, and will not seem unreasonable to those who have tried to deal with works in Polish or Hungarian which sometimes appear. It is: "Article 69. Publications are only admissible for competition for valid nomenclature so long and so far as they are printed in Latin characters and appear in the Latin, English, French or German languages; but for gothic characters this has no retrospective force." To be strictly just this should include Italian; in other respects the rule is desirable.

Section 15, additions, etc., to Pritzel's Thesaurus and § 16, a vigorous and well written article in English on "Modern English Nomenclature" close the introduction.

The revision itself follows, the genera in each family being taken up alphabetically. Details of all kinds abound in notes, etc., and are often very interesting (e. g., notes on proper spelling, on botanical Latin, etc.). But no confusion is produced by them or the revisions of genus-limits and monographs scattered through the work. One thing might be mentioned. He unites Aster and Solidago and intermediate groups in the genus Aster, giving quite a full discussion of his reasons. He also works out the proper species-name combinations whenever he changes a genus-name. Many things might be commented upon did space permit, but the introduction indicates the nature of all the changes.

Just what the effect of the work will be cannot be foretold. Many of the suggestions will hardly be adopted. Others, it is to be hoped, will be. As the most thorough piece of work yet done in a direction now receiving much attention it must have some influence. Certainly the admirable discussion in the introduction of the defects of our present nomenclature and the causes of them cannot fail to have considerable effect, and constitutes the most valuable part of the work. The author appears in the introduction as a keen and severe, yet on occasion, appreciative critic, and if we are to believe his statement that he worked from thirteen to fourteen hours a day for the last three years, no one can charge him with haste, or say as he does of Durand, that he has not put time enough upon his work.

One acquires a good deal of prejudice against the book on first glancing it over, which disappears on a more thorough reading of the introduction. Paradox as it is, the only way to attain an unchangable and uniform nomenclature is to make changes now with an iron hand. "Unambiguous rules and priority," as he ever says, "are the only sound principles by which we can bring order in [to] nomenclature. The changes necessitated by priority should.....be made as promptly and as thoroughly as possible, and—as we may wish it—if possible at once, in one book.—Roscoe Pound, *Lincoln, Nebraska, February* 8, 1892.

Literature of Parasites, No. II.—M. Braun. "Die sogenannte freischwimmende Sporocyste." (Centralblatt f. Bakl. u. Par. 1891, X 7, p. 215–219.)

In 1885 Prof. Ramsay Wright, of Canada, found a peculiar free-swimming organism which he considered to be a free-swimming sporocyst. Prof. Braun, of Königsberg, recently found some similar organisms, which he traced to *Limnaeus palustris* var. *corvus*. Braun dif-

fers, however, in his interpretation of these organisms from the views advanced by Wright and afterwards accepted by Leuckart, in that he considers that we have in this case not a sporocyst stage but a *cercaria stage, in which the anterior portion of the body (the Distoma) has crawled into its own tail.* He has given the name *Cercaria mirabilis* to the larva, but is as yet unable to tell to what species of Distoma it belongs. Prof. Braun's view seems to be the correct one, as he examined the organism in various stages of development.

Dr. Raphaël Blanchard, "Histoire Zoologique et Médicale des Téniadés du genre Hymenolepis (Weinland)." Prof. B. begins with a former review of works on this genus, dwelling at some length on Grassi's experiments, in which the latter showed that *H. murina* has an indirect development *without* change of host.

The embryo enters the villosities of the intestines, where it develops into a cercocystis, which afterwards becomes free in the lumen and develops into the adult tape-worm. This is the only case where it has been demonstrated that a Tænia can pass its full development without change of host.

Blanchard's diagnosis of the genus Hymenolepis is as follows: Body small, filiform; head small, provided with a retractile rostellum—well developed and armed with a simple crown of 24–30 minute hooks or rudimentary and unarmed; neck long; segments serrated, much wider than long, in number rarely less than 150. Sexual pores marginal, piercing the left border, the ventral face being that which is occupied by the female genital organs. The male genital apparatus contains a very small number of testes, generally but three, two of which lie in the right half of the segment, the third in the left half. Mature segments transformed into a sack full of round or oblongated clear eggs; there are three concentric yet separated egg shells. The internal shell contains the oncosphere (six hooked embryo), possesses no pyriform apparatus, but sometimes shows a papilla at each pole. The larvæ is either a cryptocystis (cercocystis) or a staphycystis. Development is indirect, either without change of host, but with a migration from one organ to another, or more frequently with change of host, the intermediate host being an insect or myriapod.

A list is then given of all the know species (14 according to Blanchard), their hosts, intermediate hosts and larval forms, so far as known. Blanchard is not ready to accept Grassi's view that *H. murina* of the rat and *H. nana* of man are identical.

The latter half of the book is given up to the more purely medical side of the question. Diagnosis, symptoms, treatment, etc.

H. nana has been found in man in Egypt, England, Italy, United States of America and Argentine Republic. *H. diminuta* (*flavo-punctata*) in America and Italy.

Complete bibliography of the genus follows.

The work is well done and like most of his work exhausts the subject up to date.—C. W. STILES, *Washington, D. C.*

EDITORIALS.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

—THE address of Prof. Kölliker as President of the Munich meeting of German Anatomical Society contains some words which are deserving of repetition in this country.

Referring to the literature of Anatomy, he expresses the wish that all morphologists would agree to publish their observations only in one of the four best-known languages, and at the same time that it is desirable that all anatomical contributions should appear in a few specified journals. He makes the following suggestions: (1.) Every author who writes in another language than English, French, Italian or German should provide, as is already often the case, a short abstract in one of these languages. (2.) It would be of great value if every country possessed a journal which should give as soon as possible a short abstract of every paper which appears outside of the special journals. It is often the case that important papers lie long buried in society transactions which would thus have their value and significance placed before the public. A few words follow upon the possibilities of a universal language, in which the claims of Volapük and the like are dismissed in short order. "The savants of the middle ages possessed a genuine universal language in the Latin, and it is only in such wise that one is possible to-day; in such connection English or French are first to be thought of."

The rapid advance of English to the position of a universal language has attracted the attention of all students. English is spoken to-day by over 125,000,000 people; no other language of Europe, excepting the barbaric Russian, is spoken by half that number. English has an additional claim from the ease with which it can be learned. It has developed further (has degenerated, if you will) in that it has largely lost its inflections, and this fact has added not a little to its simplicity and to the facility with which it may be acquired, while its capacity for adopting Latin and Greek roots is an important element in its favor.

Another word in relation to the address of Prof. Kölliker. There is to-day no other journal in America which offers itself for the publication of preliminary communications in all departments of natural science; there is none other which attempts to give abstracts of work published elsewhere. Our readers know what we have done in this respect in the past; we feel that we can promise that the NATURALIST will in the future excel its past so far as this department is concerned.

—A COMPARATIVELY small number of persons, even in intelligent communities, regard scientific pursuits seriously unless there is some financial consideration attached. To the habitual cultivator of science or other ideal occupation, the devotion of the majority of mankind to money getting seems like a misfortune. The philosopher, however, knows that were men relieved of this necessity, the majority of them would be still less profitably employed, and the race as a whole would degenerate. Nevertheless the number of men who believe it to be true, that the pursuit of pure science and philosophy are necessary to human development, is increasing. But of this enlightened class a considerable proportion appear to think that human knowledge will grow of itself like grass, and that artificial aid is unnecessary. These remarks are made apropos of a phenomenon frequently observed in the city where this journal is published, and we have no reason to suppose that other localities differ from it in this respect. A dance or a dinner party is a most successful rival of an emergency to be met at a meeting of a society devoted to the pursuits of science or philosophy. Where the heels or the stomach have the call, the brain has to retire into "innocuous desuetude." The limited revenues of science may be misappropriated or absurdities perpetuated in her name, while her alleged patrons cultivate less important matters. Dinners and dances may be indefinitely repeated, but action by corporate bodies is only lawful at stated times, and the results of such action are far-reaching, both in scope and time. With a higher civilization we will respect our brains more and our stomachs less, and still have a mutual understanding between brains and stomach which will be beneficial to both parties.

—GENERAL ISAAC T. WISTAR, President of the Philadelphia Academy of Natural Sciences, has added his name to the honorable list of those who have given pure science a permanent endowment. He has placed in the hands of trustees for the benefit of the University of Pennsylvania, $100,000 for the erection of a museum with laboratories, to contain the Wistar and Horner Museum of Human and Comparative Anatomy, and has added an endowment of $3,000 per year for the maintenance of a curator, whose occupation shall consist largely of original research. Although there are several positions in Philadelphia occupied by distinguished investigators, this is the first permanent endowment distinctively devoted to this purpose which we have.

—THE newspaper press announced a few months ago that the Agricultural Department of the U. S. Government had determined to introduce the mongoose into the West to exterminate the rodents which annoy the farmers of that great agricultural region. Among other protests sent to Washington against this proposition, was one written by one of the editors of the NATURALIST. The following reply was received:

DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C., Feb. 8, 1892.

DEAR SIR: Replying to your letter of the 7th inst., respecting the introduction of the mongoose into the United States, I beg to say that this department has never contemplated any such rash act, the introduction of exotic species being contrary to the policy of this department.

Respectfully,

EDWIN WILLITS,
Assistant Secretary.

This reply gives us great pleasure, since evil has almost invariably resulted from the introduction of exotic animals into countries when no adequate natural restriction to their increase exists. It should be the duty of an Agricultural Department to impress on our farmers and others the importance of preserving the natural balance of life in the country as nearly as possible. If insectivorous birds are destroyed, vegetation will be overrun with insects. If the snakes are destroyed the smaller mammals will increase indefinitely. A good deal of pains is taken to protect birds in some of the States, but none whatever to protect the harmless snakes. These animals are the natural destroyers of the rodents, moles, etc., which are so destructive, and they inflict absolutely no injury. Yet one can hardly open a newspaper without reading of some men or boys who have found a den of snakes and have as a matter of course destroyed every one of them. This is not only a crime, but a blunder, and the grade of a man's intelligence is low who allows himself to commit it.

—PROF. BURT G. WILDER, in a recent paper, makes a good suggestion. All naturalists make mistakes, and he proposes that each writer, either as soon as he finds some error in some of his published work, or periodically, have a public confession of sins. It certainly is more agreeable to acknowledge one's faults than to have some stranger, often in the most polemical manner, point out all of our sins of omission or commission.

—THE NATURALIST has again changed publishers, and we hope that we will not again have to undergo the ordeal. The numbers can now be issued at the proper time if subscribers will be equally prompt in making payments. The number for December, 1891, was issued Feb. 1st, 1892. The late publishers failed to state this on the last page of that issue as requested by the senior editor.

General Notes.

GEOGRAPHY AND TRAVEL.

Recent Australian Exploration.—It was believed early in this century that the wholly unknown interior of Australia was watered by a great river system reaching the sea in the deep bays of the northwest part of the continent. It was to establish this supposed fact that Capt. Sir Philip King sailed along this coast in 1820, entering all the deep inlets to find some great river mouth. One day he sailed twenty-five miles up Hanover Bay, discovering a large river which he named the Prince Regent. The next year he ascended the river for fifty miles. Nearly seventeen years elapsed before another expedition under the command of Sir George Gray, was sent to Hanover Bay to complete the exploration of the river. The natives fell upon the party and wounded its leader so badly that he hastened back to civilization. From that day until last year no further effort was made to solve the problem of the Prince Regent River.

The latest *Petermann's Mitteilungen* contains a report of the expedition led a year ago by Mr. Joseph Bradshaw, of Melbourne, through this wholly unknown part of Australia. Landing at Wyndham, on Cambridge Gulf, with four white companions and two natives and a supply of provisions carried on pack horses, the little party plunged southwest into the unknown wilderness towards Prince Regent River. They had not gone far before they met natives as wild as any that were ever dismayed by the apparition of white men. The savages living along one river plunged into the water and swam across the stream upon the approach of the expedition.

Nearly all the way to the Prince Regent River the party traveled through tall grass. One species known as the black oat grass was from nine to twelve feet high, and it was difficult for the little caravan

to force their way through it. At one place, where many enormous sandstone blocks were scattered over the plain, they found numerous large holes excavated in the boulders in which the natives had stored the bones of their dead. The skeletons were not preserved intact, but the bones were packed closely together, and large stones covered them, apparently to prevent wild dingoes from scattering them. These curious mausoleums were found along a creek which Mr. Bradshaw named Sepulchre Creek. Here also he found a hitherto unknown fish of fine flavor which he was not able to find in any of the other rivers. He proved that the great desert of inner Australia does not extend thus far to the northwest, for the region through which he passed was watered by scores of creeks and rivers, while tropical vegetation luxuriantly flourished.

One day the party came to an unexpected impediment. A wall of high hills rose so precipitously that it was impossible to lead the horses up the slope. After hours of search a narrow valley was discovered between whose steep, high sides they traveled for about a mile until they reached the summit of a comparatively level, well-grassed plain. On this plateau they traveled for several days before they descended on the other edge. They found it very difficult to get through the tangle of hills bordering this little plateau on the western side, and for four days they were busy with axes under the glowing heat of the tropical sun cutting a road for the horses. A little beyond they ascended a mountain about 1,500 feet high, from which a very fine prospect extended from all directions.

On all sides stretched away the hills of lesser elevation, covered to their tops with thick growing grass, while as far as the eye could reach could be seen a great abundance of lagoons and watercourses fringed with papyrus and palms. It was a fine tropical prospect and very different from the semi-arid region which must begin not a great distance to the southeast.

Mr. Bradshaw was particularly struck with the work of white ants in the western part of the region he traversed. In one place, for instance, he discovered a perpendicular pillar with a diameter of about three feet and nearly ten feet in height. It stood in the middle of an enormous rock, at least forty feet from the nearest bit of soil. All the material for this structure must have been carried by these little insects forty to fifty feet, involving enormous labor.

As the party neared the Prince Regent River the country became more difficult to traverse on account of the steep hills, the great blocks of porphyry and sandstone in their way, and the tall grass.

Sometimes they traveled for hours up a valley to find that it was cul de sac, and all their labor was lost. At last they struck the Prince Regent River, and here they found many natives, doubtless the children of those that had attacted Sir George Gray. They were very shy, and were painted with red and white stripes in a wonderful manner. Many of them wore a curious headdress made of papyrus. As weapons they carried spears and nullis, as well as bows and arrows, but no boomerangs were seen.

The Prince Regent River was reached just a little above the point attained by Sir Phillip King. In a straight line they were about 150 miles from their starting point, but they had traveled nearly double that distance. It is a beautiful river, about 200 feet wide at the place where Bradshaw struck it, and its waters coming from the Leopold Mountain chain, which is marked on the maps, are cold and refreshing. The party ascended the river, only to find that about a day's journey above the place attained by Sir Philip King a splendid waterfall puts an end to navigation. This waterfall extends from bank to bank and the entire volume of water has a perpendicular fall of thirty feet. They traveled for five days along the river bank above the waterfall to mountains through which the river flows, and along the rocky walls that hem in the narrow river they found many caverns on whose walls the natives had made paintings in red, black, white, brown, yellow, and light blue. There were figures of men with profiles well drawn, and kangaroos, wallabies, crocodiles and other animals were graphically portrayed.

The noteworthy discovery was made that for a distance of fifty miles the Prince Regent River flows between two entirely different rock formations. The right shore is composed of basaltic rocks and the left is sandstone. The territory on the right bank is well wooded and grassed, while on the west there is found mostly only prickly spinifex and black oat grass with boulders strewn over the country.

Mr. Bradshaw was well satisfied with the result of his journey. His purpose was to ascertain if this region was adapted for cattle raising. He has satisfied himself fully that ranches can be established to good advantage at many places between the northern coast and Prince Regent River. South of the river vegetation changes its character and doubtless merges at no great distance into the almost verdureless expanses of the great thirst region of inner Australia. His party was very short of provisions before they got back to Cambridge Gulf, where they arrived on May 14. They, however, eked out their rations with wild turkeys, kangaroos, iguanas and fish, and at Cam-

bridge Gulf they were glad to find again some of the comforts of civilization in the huts of the hospitable Chinese who occupy the most advanced post of civilization in that region.

Bradshaw's journey has revealed the character of one of the large unexplored regions of Australia. About the same time David Lindsay was crossing the greatest unknown expanse in southwest Australia. He has now gone north to traverse an unexplored district in the west central part of the continent, and when he completes this journey there will be no large region in Australia that is not fairly well known in its general aspects.—*N. Y. Sun.*

GEOLOGY AND PALEONTOLOGY.

The Genus Scolithus.—Mr. Joseph F. James read a paper before the meeting of the Geological Society at Washington entitled "Studies in Problematic Organisms—The Genus Scolithus." After a lengthy review of the literature concerning this subject, the author discusses the fossils as follows:

"There have been described of the genus from North America the following species:

Scolithus (*Fucoides*) *shepardii* Hitchcock, 1833 (Triassic).

S. linearis Haldemann, 1840 (Lower Cambrian).

S. (*Fucoides*) *verticalis* Hall, 1843 (Portage).

S. clintonensis (n. sp.), proposed for *S. verticalis* Hall, 1852, preoccupied (Clinton and Medina).

S. canadensis Billings, 1862 (Potsdam).

S. minutus Wing, 1877 (Calciferous).

S. tuberosus Miller and Dyer, 1878 (Cincinnati).

S. (*Arenicolites*) *woodii* Whitfield, 1880 (Potsdam or St. Croix).

S. delicatulus U. P. James, 1881 (Cincinnati).

S. dispar U. P. James, (*Eophyton dispar*), 1881 (Cincinnati).

S. minnesotensis (n. sp.), Winchell, 1884, described but not named (St. Peters).

The geological range of the genus appears from this list to be from the Lower Cambrian to the Triassic. *S. shepardii* from the Triassic does not differ in any essential respect from *S. linearis* from the Cambrian. It is impossible to separate *S. verticalis* of the Portage from *S. clintonensis* of the Clinton and Medina, or either of these from *S. linearis*. As we have already shown, *S. canadensis* and *S. linearis*

may be considered identical; while *S. minutus* from the Calciferous and *S. woodii* from the Upper Cambrian of the Mississippi Valley may be said to be separable by no definable characters. *S. delicatulus* from the Cincinnati differs from *S. minutus* only in having the cavities of the tubes filled instead of being hollow. Finally, *S. minnesotensis* from the St. Peter is the same, so far as characters go, as *S. linearis* from the lower Cambrian.

It cannot be considered as at all probable that the annelid living in the lower Cambrian and making the perforations we know as *S. linearis* persisted in the same form through all later geological periods into Triassic time. Mr. Walcott does not think it probable that the same species ranged even through Cambrian time, to say nothing of a much greater time-range. Yet he places forms from the lower and from the upper Cambrian under the same specific name. On the same principle we should unite all the species, in whatever geological horizon they may occur, under one name, for there are no characters to distinguish one from another. But this does not seem advisable, and under the circumstances I would propose that the geological position shall decide the name to be used. Thus, *S. linearis* might be applied to forms from the lower Cambrian rocks of the eastern United States; *S. canadensis* to those occurring in upper Cambrian strata of the eastern United States, and *S. woodii* to those from strata of similar age in the upper Mississippi Valley; *S. minutus* might be the name for the form in Calciferous strata; *S. minnesotensis* might be applied to the forms from the St. Peter, and *S. delicatulus* to those in Cincinnati rocks; *S. clintonensis* might be applied to those from Clinton and Medina strata, *S. verticalis* to those from the Portage, and *S. shepardii* to those from the Triassic. It is probable, also, that a name should be given to forms collected from other horizons, say *S. arizonicus* to the form from the Grand cañon in Arizona.

Several objections may be urged against such an arrangement. One of these is that it robs the genus of all value as indicating the age of the rocks in which it occurs. This is true. It deprives *Scolithus*, too, of any value as a means of correlating rocks of two different sections, one with another. This is also true, and so it should be. No valid argument can be brought forward to justify placing the rocks of two widely separated areas in the same terrane upon the evidence of such a form as *Scolithus*—a form of indefinite character, of indefinable features, of perplexing variability, and of wide time range. The use of forms of this sort as a means of correlation is even worse than the use of lithological characters. Time does not permit mentioning the

erroneous correlations resulting from the use of *Scolithus*, but they are numerous enough.

The second objection urged will probably be the multiplication of names resulting. Some will, perhaps, prefer to let *Scolithus linearis* do duty for all the forms if they can be shown to be indistinguishable, but this objection does not seem to me to be a valid one. Dr. C. A. White, in a paper read before the American Association for the Advancement of Science last year and published in volume 39 of the Proceedings, in speaking of applying new names to fossils occurring in two different formations, says that "if a given formation is found to bear a fossil fauna the component members of which, with such exceptions as have been referred to (i.e. forms considered identical in two formations) are all unlike those of any other known fauna, I think it admissable to treat the whole fauna as new and to give a new name to each species" (p. 242). My own studies of *Scolithus* led me to adopt this method previous to reading Dr. White's paper, and I have therefore proposed, as seen above, to characterize the species of *Scolithus* upon the formation, and not, as has been done at times, the formation on the occurrence of the species."

The paper by Mr. James was discussed by N. S. Shaler and E. W. Claypole. Professor Shaler advised neglecting altogether the specific names for *Scolithus*, since it is at best only a hole in the rock. He also regarded Billings' observations on sponge spicules as valueless, because anything so widely distributed as these spicules would be swept into small crevices or openings, such as the *Scolithus* perforations. Professor Claypole remarked that *Scolithus* persists to the present time.

The Sirocco as a Disintegrating Agent.—Mr. John B. Cooke cites a number of facts (Science-Gossip Jan. 1892) to show that the sirocco is an important agent in planing down and molding the hills and valleys of the Maltese Islands. Its effect may be traced on every rock and boulder. Of the exteriors of walls and houses, the side that is exposed to the sirocco always presents an eroded and time-worn appearance, while the other sides are fresh and unworn. It is not uncommon to find stones almost completely worn through. In the old fortifications that were erected by the Knights of St. John, such phenomena are of frequent occurrence. From a series of calculations of the rate of the erosion of the Globigerina Limestone in a number of buildings of known ages, Mr. Cooke estimates the denudation due to the sirocco at 22 tons of material annually from every acre of surface.

Vertebrate Fossils at Samos.—At a recent meeting of the Academy of Sciences of Paris, M. Forsyth Major gave a very nearly complete list of the fossil vertebrates found at Samos. Of the forty-three species of mammals discovered, twenty-five at least were equally represented at Pikermi, thirteen at Maragha, seven at Baltavar and seven at Mount Léberon, so that the inference is that these different formations are probably of the same geologic age.

In fact, the author has remarked, in a new communication to the Academy, that this fauna can now be traced continuously from Spain to eastern Persia, thus proving continental conditions; so true it is that a marine equivalent is not found in these countries. The uniformity of the fauna suggests a uniform environment, and especially of climate throughout this great tract of country. Also, the vast number of horses and ruminants reveals the existence of plains or plateaus of wide extent. All these conditions permitted the distribution of the animals over an enormous area in a comparatively short time, and the mingling of individuals from localities far distant from each other would be another factor preventing a tendency to vary. (Revue Scientific, 28 Nov., 1891.)

Geologic Correlation by Means of Fossil Plants.—In a paper read before the American Association for the Advancement of Science at Washington, Aug. 21, 1891, Mr. Lester F. Ward showed what an important factor is Paleobotany in the determination of the age of deposits widely separated, as well as more nearly related formations. For this determination, however, it is necessary to have a body of facts; i.e. a fair series of good specimens. He instanced, as examples, the beds of Chardonet, referred by Elie de Beaumont to the Mesozoic which are now known to be Carboniferous. Or, coming nearer home, the clays of Gay Head, Mass., which geologists had described to be of tertiary age, until the discovery by Mr. White of a bed of fossil plants which proved to be types of the Amboy clays of New Jersey, and therefore represent the Cretaceous.

In order to make use of the principles of Paleobotany in geologic correlation, Mr. Ward proposed the preparation of tables of distribution, (1) American, (2) Foreign which should contain (a) identical and (b) related species. The fact to be borne in mind is that correlation established by such data is homotactic and not necessarily chronologic. (Am. Geol. Jan. 1892).

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—Chrustschoff[2] has re-examined the rock of Island Wallamo, in Lake Ladoga, Finland, that was first described by Kutorga as a crystallized labrador-granite. Two varieties were recognized by Chrustschoff, the one a dark-brown dolerite, composed essentially of tabular plagioclase, idiomorphic pyroxene, olivine and a little glass, with sanidine surrounding the plagioclase, and quartz crystals embedded in micro-pegmatite, occurring in the interstices between the plagioclase crystals. The second type is a dark-green diabase-like rock, whose constituents are the same as those of the first-mentioned rock. In this quartz and orthoclase are rare. These rocks are cut by narrow dykes and veins of granophyre, without peculiar features. In explanation of these phenomena the author states that the original rock was an olivine diabase that had solidified, with the exception of its glassy ground mass, when it was intruded by granophyre. The acid magma partially dissolved the crystals and the unsolidified glass of the intruded rock, and so produced an orthoclase quartz aggregate. The basic plagioclase was corroded, and sanidine separated from the mixture formed by its solution in the acid magma, while the remaining acid material cooled as granophyre.——Deecke[3] gives a very detailed account of the geological and petrographical relationships of the gray tufa of the Campagna, Italy, which he believes to be a product of the volcanoes of the Phlegraean Fields. This tufa now consists of a colorless or pale yellow glass, in which are imbedded fragments and crystals of a very soda-rich sanidine, augite and biotite. The rock is thus an augite-trachyte. An analysis of the crystals of sanidine gave:

SiO_2	Al_2O_3	FeO	CaO	MgO	K_2O	Na_2O	Loss	Total
63.79	20.87	1.09	2.06	.41	7.56	3.72	.42	99.92

Besides the fragments of minerals there are also found enclosed in the tufa pieces of augite-trachyte, pumice and obsidian, fragments of hornblende-trachyte, and others of sedimentary rocks. A noticeable and very characteristic feature of the tufa that distinguishes it from others occurring in the same region, are the numerous geodes distributed in great numbers through its mass. These contain a yellowish powder, consisting of sanidine, tufa-fragments and fluorite. They are

[1]Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2]Geol. Fören. i. Stockh. Forh. 13, 1891, p. 149.

[3]Neues. Jahrb. f. Min., etc., 1891, I, p. 286.

supposed to have originated by the gradual decomposition of lapilli enclosed in the ash.——Hutchings[1] records the existence of tremolite and garnet in the flags at Shap, England, where they have been altered by the intrusion of granite through them. The tremolite is produced in the contact zone within the zone of spotted slates, and the garnet in about the same zone as the 'knoten,' but in different beds. The minerals producing the spots in the contact rocks are of different natures. In some cases white mica is the new product found, while in other cases it is probably andalusite. The clay slate needles that are present in large quantity in the unaltered flags continue to exist even in those rocks in which brown mica has begun to form. In the phases in which brown mica is abundant and newly-formed quartz is present the needles have disappeared, and in their place are found crystals and grains of rutile and sphene. In another stage of the contact action groups of large rutile crystals are observed, and in the neighborhood of spots are clusters of anatase crystals.——In central Siberia are mighty dykes and flows of basic rocks, among which Chrustschoff[2] recognizes ten types of augite—plagioclase—olivine rocks, containing more or less orthorhombic pyroxene and orthoclase. Their structure varies from the gabbroitic to the basaltic. Each type is described in detail and a photograph of it appears with the description. Even in the most glassy varieties well developed orthoclase exists. The principal structures noted are the gabbroitic, ophitic, with and without glassy base, anamesitic and aphanitic, with small crystals of feldspar. ——Mr. Rutley[3] describes very briefly a few sections of basalt or andesitic glass from Caradoc Hill, in Shropshire, Eng. At present the rock contains no olivine, but certain peculiar arrangements of magnetite grains indicate its former existence in them. With the glass are a basalt tufa and perlitic felsitic rhyolites with obscure flowage structure, and some with spherulites. An interesting spherulitic and perlitic obsidian is also described by the same author[4] from Pilas, Mexico. In this the perlitic cracks were certainly formed subsequently to the spherulites, and were afterwards filled with secondary silica and perhaps other substances.——Much of the so-called anthophyllite and actinolite in the rocks associated with the iron ores of the Lake Superior region is a monoclinic magnesian amphibole, corresponding to grü-

[1]Geol. Magazine, 1891, p. 459.

[2]Bull. d. l'Acad. Imp. des Sci., d. St. Petersb. Mél. géol. et paleont. T. I, p. 81.

[3]Quart. Jour. Geol. Soc., Nov., 1891, XLVII, p. 534.

[4]Ib. p. 530.

nerite, according to Messrs. Lane and Sharpless.[1] Its refraction is 1.7. It may easily be distinguished from actinolite by its polysynthetic twinning parallel to $\infty P\bar{\infty}$ and by its optical characteristics. It is colorless or pale green or brown, and is only faintly pleochroic. An approximately correct analysis gave:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	$(NaK)_2O$	H_2O
76.32	.56	.99	6.96	12.47	tr.	2.80

Fibres of riebeckite or crocidolite have also been discovered by Lane as a secondary growth on the primary hornblende of a syenite from the S. E. ¼ of Sec. 17. T. 49, R. 25, W. in Michigan.——The principal types of olivine and anorthite skeleton crystals in some of the Vesuvian lavas have been well characterized by Rinne[2] in an article illustrated by thirty-eight figures. The olivine skeletons are elongated parallel to the axis *a*. Many are twinned, giving rise to various crosses, in one of which, whose arms intersect at nearly right angles, the twinning plane is $\infty \breve{P}2$, a new twinning law for this mineral. Intergrowths of olivine and plagioclase were noted. The anorthite skeletons often show crystallographic faces in grains no larger than .07 mm. in diameter.——Mr. Turner[3] gives a brief account of the geology of Mt. Diablo, in California, describing incidentally a uralitized diabase containing twinned augite, and in some places passing over into a diorite whose hornblende may be secondary, peridotites (lherzolites), pyroxenites (websterite) and gabbros, each of which has given rise to serpentine. In a supplement to Turner's paper, Dr. Melville records the results of the analysis of these rocks together with those of sandstones, shales and a glaucophane schist from the same region. The composition of the schist is as follows:

SiO_2	P_2O_5	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	K_2O	Na_2O	H_2O
47.84	.14	16.88	4.99	5.56	.56	11.15	7.89	.46	3.20	1.98

—A paleozoic leucite-rock, consisting of sanidine, augite, nepheline, and leucite, with the accessories anorthoclase, apatite, zircon and magnetite in a glassy base is mentioned by Chrustschoff[4] from a locality in Russia. The rock is aphanitic and resembles in appearance some of the Hohentwiel phonolites as well microscopically as in microscopic

[1] *Amer. Jour. Sci.*, Dec., 1891, p. 499.

[2] Neues. Jahrb. f. Min., etc., 1891, II, p. 272.

[3] Bull. Geol. Soc. Amer., 2, p. 383.

[4] Neues. Jahrb. f. Min., etc., 1891, II, p. 224.

structure. Sanidine phenocrysts, augite, anorthoclase and leucite lie in a ground mass of sanidine, nepheline and the other above-mentioned constituents.

Mineralogical News.—NEW MINERALS.—*Newtonite* and *Rectorite.*—Messrs. Brackett and J. F. Williams[1] suggest that the kaolinite group of minerals consists of four members, each containing one part of Al_2O_3, two of SiO_2, and one, two, three and four molecules of water respectively. The best-known of these are kaolin, with the composition $Al_2O_3\ 2SiO_2+2H_2O$, and halloysite, with an additional quantity of loosely combined water. The places of two other members they fill with the new minerals, newtonite and rectorite. The former occurs in lumps in a clay associated with the shales and sandstones of the Barren Coal Measures on Sneed's Creek in Arkansas. It is a pure white, soft, compact, infusible substance, with a density of 2.37. It is only slightly soluble in boiling HCl, but is easily decomposed by hot H_2SO_4 and by boiling NaOH. Under high powers of the microscope it appears to form rhombohedrons. Its analysis, calculated for the pure dry material, yielded $SiO_2 = 40.88$; $Al_2O_3 = 35.85$; Loss, $23.27 = Al_2O_3\ 2SiO_2 + 4H_2O$. Rectorite is found in veins in sandstone in the Blue Mountain District, about twenty-four miles North of Hot Springs, Ark. It is in soft white plates, closely resembling mountain leather. Its hardness is less than that of talc, and it is infusible. Upon heating it becomes brittle. The analysis, corrected for impurities, gives $SiO_2 = 54.67$; $Al_2O_3 = 37.22$; Loss $= 8.02$; or, if the excess of silica be regarded as an impurity, $SiO_2 = 49.99$; $Al_2O_3 = 41.16$; $H_2O = 8.84$; besides 8.78% of H_2O at 110°–115°. This corresponds to the first place in the series, viz.: $Al_2O_3\ 2SiO_2 + H_2O + Aq$. The index of refraction for the substance is low. It possesses two cleavages inclined to each other, and its acute bisectrix is normal to one of these. ρ . The crystallization is thought to be monoclinic. Tested in the kiln the substance shows properties quite different from those of kaolin.——*Plumboferrite.*—The discovery of this mineral was announced by Igelström as long ago as 1881, but since it has not been noticed in journals outside of Sweden the discoverer[2] reannounces his discovery in a recent article in German. The mineral belongs to the franklinite group, from the other members of which it differs in containing lead in place of zinc or manganese.

[1] *Amer. Jour. Sci.*, July, 1891, p. 11.

[2] *Zeits. f. Kryst*, xix, p. 167.

It is found at Jakobsberg in black, platy masses, with a red streak similar to that of hematite. As usually found it is slightly magnetic, in consequence of the inclusion of impurities. It dissolves easily in HCl, and by H_2SO_4 it is changed to a white mass consisting principally of Pb SO_4.

Fe_2O_3	FeO	MnO	PbO	CaO	MgO	$CaCO_3$
55.58	9.83	2.00	21.29	1.55	1.80	7.95

which corrected for the $CaCO_3$ becomes

Fe_2O_3	FeO	MnO	CaO	MgO	PbO
60.38	10.68	2.20	1.67	1.95	23.12

corresponding to (PbO FeO MnO) Fe_2O_3.——*Ferro-goslarite* is a zinc sulphate from Webb City, Jasper Co., Mo., of the composition Zn SO_4 = 55.2; Fe SO_4 = 4.9; H_2O = 39.00; Impur = .8. According to Wheeler[1] it occurs as incrustations on the walls of a large body of zinc-blende, with which is associated marcasite and galena. Its formation is due to the oxidation of the zinc and iron sulphides and their subsequent crystallization from solution. It is slightly yellow to brown in color, and is brittle. Its hardness is 2.5, and it loses water on exposure to the air, turning to an opaque, yellow powder in the process. ——*Rowlandite.*—Associated with gadolinite and other yttrium minerals in Llano Co., Texas, Hidden[2] has found a pale drab-green substance that is transparent in thin splinters, and has a density of 4.515. It is easily soluble in acids, leaving a gelatinous residue. Upon alteration it yields a waxy, brick-red product. A partial analysis showed the presence of SiO_2 = 25.98; Y_2O_3 etc. = 61.91; FeO = 4.69; UO_3 = .40; CaO = .19; Loss = 2.01, indicating the formula $R_4'''(SiO_4)_3$.—*Offrêtite*[3] is a new zeolite from the basalt of Mt. Simiouse, near Montbrison, in France. It occurs in very small, colorless, hexagonal crystals, with only the base and prism well developed. Their cleavage is basal. Density = 2.13 and composition:

SiO_2	Al_2O_3	CaO	K_2O	H_2O	
52.47	19.06	2.43	7.72	18.90	$= (K_2Ca)_2\ Al\ Si_{14} + 17\ H_2O.$

——*Morinite*[4] is a rose-colored mineral with a difficult cleavage par-

[1] *Amer. Jour. Sci.*, March, 1891, p. 212.

[2] *Amer. Jour. Sci.*, Nov., 1891, p. 430.

[3] Gonnard, Bull. Soc. France. d. Min. xiv. p. 58.

[4] Lacroix, Ib., xiv, p. 187.

allel to the triclinic $\infty P\breve{\infty}$. It is associated with amblygonite at Montebras, Creuse, France. Its crystals contain the three pinacoids, the prisms and several domes. The plane of their optical axis is parallel to $\infty P\breve{\infty}$, and the extinction in this face is 30°. The optical angle is variable, but it never exceeds 40°. The specific gravity is 2.94, and the mineral contains alumina, soda, phosphoric acid, fluorine and water. With it is associated another hydrated phosphate, crystallizing in pyramids.——*Darapskite, lauterite, iodchromate.*—Dietze[1] describes several new minerals from the Pampas Lantaro in Chile. The first mentioned is a double salt of sodium nitrate and sulphate, of the formula $NaNO_3 + Na_2SO_4 + H_2O$. It contains $SO_3 = 32.88$; $N_2O_5 = 22.26$; $Na_2O = 38.27$; $H_2O = 7.30$. The mineral is clear and colorless, and is in quadratic tables. Lauterite is particularly interesting as being the first iodate known to occur in nature. Its composition [$I = 64.70$; $CaO = 14.95$] corresponds to $Ca(IO_3)_2$. It occurs in well-developed, large prisms, apparently monoclinic, imbedded in gypsum or implanted in the rocks underlying the pampa. It is transparent and of a yellowish color. Its density is 4.59, and it dissolves quite readily in water. Iodchromate is a peculiar compound in that it is a double salt of the iodate and chromate of calcium, of the formula $7\,Ca(IO_3)_2 + 8\,CaCrO_4$. One analysis gave $I_2O_5 = 58.12$; $CrO_3 = 19.00$; $CaO = 22.01$. The crystals are badly developed. They are of a deep yellow color, and they dissolve easily in water.——*Paramelaconite* and *Footeite.*—Dr. Foote recently obtained from Bisby, Arizona, several specimens affording two new minerals that have been examined by Koenig.[2] One is in bronzy, pyramidal crystals, set in a mass of indigo blue needles, implanted on a mammillary substance composed of a mixture of cuprite and limonite. The dark crystals, named *paramelaconite,* are tetragonal, with a pyramidal habit resembling that of Brazilian anatase, and an axial ratio $a : c = 1 : 1.6643$. The hardness of the new mineral is the same as that of apatite. Its streak is black, and its analysis yielded: $CuO = 87.66$; $Cu_2O = 11.70$; $Fe_2O_3 = .64$. Since the CuO is in such large quantity and since it was found to include little particles of cuprite, the author concludes that the mineral is a dimorph of melaconite. The indigo blue needles are monoclinic combinations of $\infty P\breve{\infty}$, $\infty P \breve{\times} P$, $P\breve{\infty}$ and $P\infty$, with an hexagonal habit. Many of the crystals are twins, like those of harmotome. Their composition

[1] *Zeits. f. Kryst,* xix, 1891, p. 447.

[2] *Zeits. f. Kryst,* xix, p. 595.

($CuO = 63.7$; $Cu\,Cl_2 = 13.5$; $H_2O = 22.8$) leads to the formula $8[Cu(HO)_2]CuCl_2 + 4H_2O$. The name chosen for them is Footeite, after their discoverer.——*Rumpfite.*—On the clefts of pinolite, from Jassing, in Obersteiermark, Germany, Firtsch[1] found associated with talc a flaky, greenish-white, translucent mineral with a hardness of 1.5 and a density of 2.675. Under the microscope it appears to be uniaxial and hexagonal. Its composition is:

SiO_2	Al_2O_3	FeO	CaO	MgO	H_2O	Total
30.75	41.66	1.61	.89	12.09	13.12	= 100.12,

corresponding to $H_{28}\,Mg_7\,Al_{16}\,Si_{10}O_{65}$. It deports itself like a chlorite.——*Bolleite.*—Mallard and Cumenge[2] have found among the copper series of Boleo, near Santa Rosalie, in Lower California, a large quantity of a blue copper mineral that often crystallizes in cubes and octohedrons. It is associated with auglesite, cerussite, atacamite and gypsum. An analysis of the cubical forms gave:

Ag	Cu	Pb	Cl	Aq	O(by diff.)
8.80	14.22	49.10	19.48	4.38	4.02,

corresponding to $Pb\,Cl_2 + CuO\,H_2O + \frac{1}{3}\,Ag\,Cl$ or $3[Pb\,Cl(HO).\,Cu\,Cl(HO)] + Ag\,Cl$. The hardness of the crystals is but little superior to that of calcite. Their density = 5.08 and their index of rafraction is about 2.07. Sometimes the cubes are modified by the dodecahedron, but the dodecahedral faces have not their usual positions, that one most steeply inclined to each axis occurring nearer the termination of that axis than the one less steeply inclined thereto, so that the edges of the cube are replaced by pairs of two faces making re-entering angles with each other. The optical properties of thin sections of these crystals indicate that they are tetragonal, negative forms that unite to give rise to a pseudo-regular one. The octahedral crystals are in reality tetragonal pyramids with $a : c = 1 : .9873$. Boleite differs from percylite in containing silver.——Sjögren[3] describes three new minerals from Sweden. The first, *astochite*, occurs as a coarse, columnar aggregate of a blue or grayish violet color at Langban. Its cleavage is that of hornblende. Its density varies

[1]Sitzb. Wien, Ak. 99, 1890, p. 1. Ref. Neues. Jahrb. f. Min., etc., 1892, I, p. 31.

[2]Bull. de la Soc. Franc. d. Min. xiv. p. 283.

[3]Geol. Fören. i. Stock. Förh. xiii, 1891, pp. 605 and 781.

between 3.05–3.10, and its extinction between 15°40′ and 17°15′. The analysis of the blue variety yielded:

SiO_2	FeO	MnO	MgO	CaO	Na_2O	K_2O	H_2O	F = Total
56.25	.15	6.49	21.89	5.44	6.17	1.60	1.56	.15 = 99.70

The second, *adelite*, occurs at Laugban and at Nordmark in mass of a gray color, with a hardness of 5 and a density of 3.76. Its analysis leads to the formula $2CaO, 2MgO, H_2O, As_2O_5$. The third, *svabite*, is probably an apatite. It is found in colorless hexagonal prisms at Harstig Mine, Pajsberg. $a : c = 1 : .7143$. Composition = $H_2O. 10CaO. 3As_2O_5$.

BOTANY.

The Sargasso Sea.—In a recent number of Petermann's 'Mitteilungen' Dr. O. Krümmel states the result of his investigations into this interesting marine problem. In the first place, he differs entirely from Humboldt as to the shape of the floating mass of vegetation. The "great bank of Flores and Corvo" is, he says, Humboldt's summing up of the observations made by sailing-vessels passing through the Sargasso Sea on their way from the Southern hemisphere to Europe. These followed with slight variations the same course, and their observations were naturally limited in extent. It was on these insufficient data that Humboldt founded his theories as to the size and shape of the Sargasso Sea, but now, by the aid of steam, we are able to arrive at more correct conclusions on these points. On a map which he has prepared Dr. Krümmel has plotted out the general contour of the mass of floating vegetation, and has indicated in what parts of the sea the sargasso is found in the greatest abundance. In shape the Sargasso Sea is a sort of ellipse, the great axis of which almost coincides with the Tropic of Cancer, while the two foci are near long. 45° and 70° West. Around this central ellipse others are indicated, larger in size, but with the vegetation much less dense. In their general outline they follow with sufficient nearness the course of the prevailing winds. As to the origin of the algæ, Dr. Krümmel is strongly of the opinion that they come from the land—not only from the Gulf of Mexico and the coast of Florida, but from the shores of the Antilles and the Bahamas. The most recent studies with regard to the origin and course of the Gulf Stream tend, he thinks, strongly to support those who assert that the algæ come from the land, and to disprove the contention of those

who support the hypothesis of a marine origin. Now that it is settled that the Gulf Stream is not a single narrow stream issuing from the Gulf of Mexico, but an accumulation of converging currents sweeping past the coasts of the Antilles and through the adjoining seas, it is obvious that the quantity of algæ carried away must be much greater than it could have been were the old hypothesis of the origin of the Gulf Stream correct. Dr. Krümmel makes an approximate calculation as to the time occupied by the algæ in reaching the Sargasso Sea. A fortnight after reaching the Gulf proper, the weed would, at the rate of two knots an hour, reach the latitude of Cape Hatteras. From that point its onward motion is slower, and it takes about five months and a half for it to reach west of the Azores. After reaching the Sargasso Sea the weed continues to move slowly, until, becoming heavier as it grows older, it gradually sinks to make way for fresh supplies. (Proceeds. Roy. Geog. Soc., Oct., 1891.)

Ferns of the Black Hills.—Last July while collecting in the Black Hills of South Dakota the following ferns were recorded. My collecting field was in the central portion of the Hills in the vicinity of Harney's Peak. About the same time Professor Williams of Brookings, S. D. visited the eastern part of the Hills, and made a few notes which I add to mine. This list is interesting inasmuch as it is much larger than any yet made for this region, including several species not hitherto known to grow this far west.

Polypodium vulgare L.—Abundant on the rocks in and about Harney Glen, on the side of Harney's Peak.

Adiantum pedatum L.—Reported on good authority from near Hot Springs, but no specimens were secured.

Pteris aquilina L.—Specimens were seen, but not collected, between Hill City and Deadwood.

Cheilanthes lanuginosa Nutt.—On the rocks at Custer; Professor Williams collected it at Rapid City, also.

Pellæa atropurpurea Link.—On the rocks at Custer. Collected at Rapid City also by Professor Williams.

Asplenium trichomanes L.—On the rocks at Custer, and in the ravines on Harney's Peak.

Asplenium septentrionale Hoffm.—In the crevices of rocks at Custer, and in Harney Glen. This is a most curious fern, resembling a tuft of grass.

Asplenium filix-fœmina Bernh.—On moist soil at Custer.

Phegopteris dryopteris Fee.—In a bog in Harney Glen.

Aspidium filix-mas Swartz.—In moist places in Harney Glen.

Aspidium filix-mas Swartz, var. *incisum* Nutt.—What I take to be this variety was collected in Harney Glen. It differs from the preceding in having more incised pinnules, and in being freer from chaff on the rhachis.

Cystopteris fragilis Bernh.—In shaded places near rocks at Custer. The specimens collected were covered with a fine rust, *Uredo polypodii* (P.) D. C.—This fern was collected at Rapid City, also by Professor Williams.

Onoclea sensibilis L.—In shaded thickets on the sides of Buckhorn Mountain, and in ravines approaching Harney's Peak.

Onoclea struthiopteris Hoffm.—In cañon of Rapid Creek near Rapid City (Professor Williams).

Woodsia oregana D. C. Eaton.—Collected at Rapid City by Professor Williams.

Woodsia scopulina D. C. Eaton.—Common in the crevices of rocks at Custer.

Botrychium virginicum Swartz.—Collected at Rapid City by Professor Williams, who reports it to be rare.—CHARLES E. BESSEY.

Notes on the Flora of Western South Dakota.—(*Concluded from* p. 63.)—The time spent in the Black Hills region was too short to enable one to form any very accurate ideas regarding its large and varied flora. There is a mixture of Rocky Mountain forms with those of the astern flora, which with the prairie forms make the Black Hills flora ae very interesting one. The cañons are pleasing fields to the student. Working up one cañon we find in a shady nook *Lophanthus anisatus*; on the drier flats are many kinds of *Eupatorium* and *Aster*, and an abundance of *Argemone platyceras*, while on several shady banks *Onoclea struthiopteris* grows as tall as a man's head. Up a small side cañon are found *Potentilla fruticosa*, *Physocarpus monogynia*, *Arctostaphylos uva-ursi*, *Disporum trachycarpa*, and *Shepherdia canadensis*. Out into another and darker side cañon, and we see *Pyrola secunda*, *P. chlorantha*, *Maianthemum canadense*, *Pterospora andromeda*, along the dry bottom of another *Mentzelia oligosperma*, *Geranium richardsonii*, *G. carolinianum* and *G. dissectum* were collected. Far up a narrow, dark gorge grows *Mimulus luteus* with *Corylus rostrata* on the bank above. Along the higher bluffs, *Pinus ponderosa* var. *scopul-*

orum makes the greater part of the timber, but lower down in the cañons are *Betula papyrifera, B. occidentalis, Ostrya virginica,* both the junipers, *Fraxinus viridis, F. pubescens, Populus monilifera, P. tremuloides, Ulmus americana,* and *Quercus macrocarpa.* This last has a number of very interesting and perplexing forms. *Ribes gracile, R. aureum, R. floridum* are very plentiful, and when we were there were loaded with fruit, all of which was quite palatable excepting that of *R. cereum*; cherries were also plentiful. *Rubus strigosus* was abundant in many places, and was loaded with fruit, which was ripe in August.

There are a great many introduced plants in the larger valleys, and a discussion of their introduction would be interesting were one better acquainted with them and their surroundings.

Quite a number of fungi were found here. Of the lichens I shall say nothing now except that the lichen flora is very interesting, and that I found many good things.

When we left the Black Hills for the Bad Land region we followed down a stream called Spring Creek. We had been told that there was considerable timber on the stream. Most of the way down, the wagon road is at the foot of the bluffs at some distance from the stream, and no trees could be seen. We concluded that we had been misinformed. By-and-by we turned to cross the stream and found that there was a second bottom between us and the stream, and that the real valley was hidden from our sight. This was covered with a fine growth of elm, ash, hackberry, boxelder, willow, etc. There is wood enough along this one stream to keep a whole county in wood if rightly used.

The Cheyenne Valley, at the mouths of Spring Creek and Indian Creek, differs but little from that in the vicinity of Smithville before mentioned.

By following up the Indian Creek Valley one can enter the Bad Lands proper in the vicinity of Sheep Mountain. This flora is also interesting. All the plants, excepting a few stunted introduced species are of the kinds adapted to a dry climate and poor soil. The chenopods are well represented by *Atriplex nuttallii, A. argentea, A. patula,* var. *hastata, Sarcobatus vermiculatus* and several species of *Chenopodium. Atriplex nuttallii* and *Sarcobatus vermiculatus* are most plentiful on the sterile sides of the buttes and hills, both becoming quite shrubby with age. The old stems are often well covered with several species of lichens. Along the sides of Sheep Mountain and some other of the more favored places *Juniperus virginiana* is quite

abundant. The valleys bordering the streams are sometimes quite well sodded with grass, but no species of much importance are found except in the larger valleys or in the basins. *Andropogon scoparius* is the commonest of these grasses. It is of no use at all as a forage grass, since stock will not eat it either green or as hay, and but few machines can be found that will cut it. In some of the larger basins *Boutelua racemosa*, several species of *Calamagrostis*, *Spartina cynosuroides* and *S. gracilis* and *Panicum virgatum* are the principal forage plants.

The timber of the Bad Land streams consists chiefly of *Populus monilifera*, *Shepherdia argentea* and an occasional elm, box-elder or ash. *Physaria didymocarpa* is very common throughout the whole region, its thick, fleshy leaves reminding one of the large-leaved Sedums.

Astragulus is represented by *A. bisulcatus*, *A. sericoleucus*, *A. gracilis*, *A. missouriensis* and *A. caespitosus*. *Sophora sericea*, abundant all along the Cheyenne, gets up into the woodlands in many places. The Cacti are represented by *Opuntia rafinesquei*, *O. fragilis*, and *O. missuriensis*, in many puzzling forms, *Mamillaria vivipara* and *M. missuriensis*. All these are plentiful, *O. fragilis* and *O. rafinisquei* apparently preferring the higher table-lands and the others the basins and lower table-lands. *Rhus radicans* and *R. canadensis* var. *trilobata* occur in many places.

Almost in the centre of the Great Basin there is a veritable oasis. At the base of a long hill of considerable height there is a cluster of springs known as Iron Springs, from the peculiar taste of the water. The entire hill seems to be made of better soil than the surrounding country, for it is covered with a fine growth of grass, including many of the best species, as *Boutelua racemosa*, *Andropogon furcatus*, *A. nutans*, *A. hallii* and *Panicum virgatum*. Here we also found *Eurotia lanata*, *Psoralea cuspidata*, *P. lanceolata*. *P. argophylla*, *P. digitata* and *P. tenuiflora*, *Aster multiflorus*, *Artemisia ludoviciana*, *A. longifolia*, *A. filifolia*, *Agropyrum glaucum*, *A. tenerum* and many other prairie species. Along the more abrupt sides of the hill grew *Celtis occidentalis*, *Juniperus virginiana*, *Populus balsamifera*, *P. monilifera*, *Ulmus americana*, *Prunus virginiana*, *P. americana*, *Acer negundo*, *Fraxinus viridis* and *F. pubescens*. In the immediate vicinity of the springs a great many plants were found that one would hardly expect. Some of the finest plums, either wild or cultivated, that I have ever eaten grew on bushes fringing the springs. Here also were elm, ash, blackberry, cherry, box-elder, willow, *Ampelopsis quinquefolia*, *Ribes aureum*, *R. floridum*, *R. gracile*, *Parietaria pennsylvanica*, *Symphoricarpus occi-*

dentalis, Polygonum dumetorum var. *scandens, Phryma leptostachya, Distichlis maritima, Lemna minor, L. polyrrhiza, Mimulus jamesii, Spartina cynosuroides* and *gracilis,* with other species common to prairie and timbered regions. Many of the species found at these springs were found no nearer than the Black Hills or the Missouri River, yet here they seemed to flourish in the very centre of the great Bad Land region.

I append a list of a few of the more characteristic species of each of the three regions.

The Range. — *Stipa comata, Boutelua hirsuta, Boutelua oligostachya* and *B. racemosa, Agropyrum glaucum, A. repens, Yucca angustifolia, Sophora sericea, Shrankia uncinata, Psoralea argophylla, tenuiflora, cuspidata* and *esculenta, Astragalus caryocarpus* and *flexuosus; Gutierrezia euthamiæ, Solidago missouriensis, canadensis* and *serotina; Helianthus petiolaris, Marsilia vestita.*

The Black Hills.—*Onoclea struthiopteris, Juniperus communis* and *virginiana; Picea alba, Pinus ponderosa* var. *scopulorum, Betula occidentalis* and *papyrifera; Erigeron salsuginosus, Ostrya virginica, Corylus rostrata* and *americana; Pyrola chlorantha* and *secunda; Pterospora andromeda, Androsace septentrionalis, Hedeoma drummondii, Lophanthus anisotus, Mimulus luteus* and *ringens; Shepherdia canadensis, Euphorbia dictyosperma, Sambucus canadensis* and *racemosa; Aralia nudicaulis, Actæa rubra* and *alba; Disporum trachycarpum, Geranium richardsonii, carolinianum* and *dissectum; Mentzelia oligosperma, Quercus macrocarpa.*

The Bad Lands.—*Spartina gracilis, Sporobolus airoides, Sporobolus asperifolius, Andropogon hallii, Physaria didymocarpa, Astragalus sericoleucus, Astragalus caespitosus, Astragalus gracilis, Astragalus pictus, Œnothera caespitosa, Sarcobatus vermiculatus, Atriplex nuttallii, Parmelia molliuscula, Urceolaria scruposa* var. *gypsacea, Ulceolaria scruposa,* var. *parasitica, Tylostoma mammosum, Geaster delicatus.*—

T. A. Williams.

ZOOLOGY.

Work of Earth-worms in Yoruba Country, West Africa.—In the Proceedings of The Royal Geographical Society, October, 1891, Mr. Alvan Millson gives the following account of the extraordinary work done by West African earth-worms.

"Northward from Ibadan, which may be described as the centre of the chief military and commercial power in Yoruba, two days journey—about forty miles—through many villages, and a landscape dotted far and near with oil-palms (*Elais guineensis*), along a road thronged with travelers, brings one to the capital of central Yoruba, Oyo (Awyaw). On leaving Ibadan I passed in the course of our morning's march over 4700 men, women, and children, hurrying into the great city from the farm villages, with loads of maize, beans, yams, yam flour, sweet potatoes, fowls, pigs, ducks; or driving cattle, sheep, and goats; or mounted on small native horses which amble quickly along under the combined influence of an Arab ring-bit and an armed spur which leaves its traces in deep scores along the flanks of the poor animals.

"Far and wide the land has, for generations, and indeed for centuries, been cultivated by these industrious natives. The hatchet, the fire, and the hoe have removed all traces of the original forest, save indeed where a dark trail of green across the landscape shows where the valley of some narrow watercourse or larger river is hidden among trees.

"For two or three years at most the land is allowed to lie fallow, while for three or four years double or treble crops are raised with no further cultivation than an occasional scrape with a hoe, and during its fallow time no further care is taken of it than to let a rank growth of reedy grass spring up some six or eight feet in height. Among this grass can be seen the seedlings and young plants of a new forest which would rapidly take possession were the land to be permanently deserted.

"In spite of this careless and exhausting method of cultivation the crops maintain an excellent average, and the same plot of ground serves for generations to support its owners.

"The following extracts taken from notes taken at the time will serve to explain the apparently inexhaustible fertility of a soil which does not at first sight show any signs of unusual richness.

"Were one to visit Yoruba during the early part of the rainy season only, it would appear impossible to account for these facts . . . . . while under our feet unnoticed was going on the ceaseless labor of the real fertilizers of the land.

"In the dry season the mystery is at once solved, and in the simplest and most unexpected manner. The whole surface of the ground among the grass is seen to be covered by serried ranks of cylindrical worm casts. These worm casts vary in height from a quarter of an inch to three inches, and exist in astonishing numbers. It is in many places impossible to press your finger upon the ground without touching one. For scores of square miles they crowd the land, closely packed, upright, and burned by the sun into rigid rolls of hardened clay. There they stand until the rains break them down into a fine powder, rich in plant food, and lending itself easily to the hoe of the farmer. Having carefully removed the worm casts of one season from two separate square feet of land at a considerable distance from one another, and chosen at random, I find the result to weigh not less than ten and three-quarters pounds in a thoroughly dry state. This gives a mean of over five pounds per square foot. Accepting this as the amount of earth brought to the surface every year by these worms, we get somewhat startling results. I may say, speaking from the result of numerous experiments, that five pounds is a very moderate yearly estimate of the work done by these busy laborers on each square foot of soil. Even at this moderate estimate, however, of the annual result of their work, we have a total of not less than 62,233 tons of subsoil brought to the surface on each square mile of cultivatable land in the Yoruba country year after year, and to the untiring labors of its earth-worms this part of West Africa owes the livelihood of its people. Where the worms do not work, the Yoruba knows that it is useless to make his farm.

"Estimating one square yard of dry earth by two feet deep as weighing half a ton, we have an annual movement of earth per square yard to the depth of two feet, amounting to not less than forty-five pounds. From this it appears that every particle of earth in each ton of soil to the depth of two feet is brought to the surface once in twenty-seven years.

"The earth-worm which produces such surprising results has been identified as a new species of *Siphonogaster*, a genus known hitherto only in the Nile Valley."

The Worm Gymnorhynchus Reptans.—M. Moniez has recently found a perfect specimen of *Gymnorhynchus reptans* in *Oxyrhina glauca*. This genus is distinguished from other species of Tetrarhynchides, known in the larval state, by a curious appendage at the end of the sac into which the animal can retract the anterior part of its body as in a cyst. This appendage, about one meter in length, forms a net-work in the tissues of its host, and it is extremely difficult to get the entire animal. Contrary to what has been supposed by Van Beneden, the sac into which the anterior part of the larvæ is retracted, as well as the enormous appendage do not persist in the adult animal, nor are they sexed; it is digested by the new host, and of this very long animal there remains only the neck and that small portion of the tissues attached to which the name "zone génératrice" has been given and upon which depends the formation of the chain of rings which complete the animal.

M. Moniez considers this peculiar appendage comparable with that found in several Cestodes of the type of *Tænia serrata*. (Revue Biol. Jan. 1892).

New Fishes from Chihuahua, Mexico.—During the months of July and August, 1891, some collections of fishes were made by the author at several points in Mexico, from Orizaba to Chihuahua; many interesting specimens were taken, several of which are believed to be new to science. The specimens here described were taken from the Rio de las Conchos at Chihuahua. The river bed here is half a mile wide in places, with numerous sand bars and depressions. It is little more than a river bed however, owing to the almost total lack of rainfall throughout the entire year. The water in this large river bed is reduced to a very diminutive stream that is brought from the mountains ten miles away by an aqueduct to supply the city with water.

A mile below the city the stream is dammed, in order to use the water for irrigating purposes. Here on one side the bank is high and rocky and the water is entirely too deep to be seined. The other bank is composed of sand, sloping gradually to the deeper water, and is easily accessible. The bottom is covered with several inches of mud, and in many places the shallow parts are thickly grown with various water weeds.

These quiet waters swarm with fish, for the most part of the minnow family.

At the upper end of the pond the water was shallow, clear, and in places swift enough to form ripples, here a number of Cyprindontidæ

and two species of darters were taken, making about sixteen species in all.

Notropis chihuahua sp. nov.—Body elongate, back little elevated, rising gradually from snout to front of dorsal; head large; snout blunt; mouth nearly horizontal, slightly oblique; maxillary scarcely reaching to front of eye; eye large, averaging 3¾ mm. longer than snout, but not quite equal interorbital space; anterior part of dorsal midway between snout and caudal; scales deeper than long, not crowded anteriorly; lateral line straight, nearly every scale with a pore.

Color, light brown above; edges of scales above the lateral line with small but closely placed black dots; body also above the lateral line thickly but irregularly sprinkled with dark brown spots, these gradually becoming more numerous toward the median line of the back, where they form a vertebral line; the side of the body with a plumbous lateral stripe, of about the width of the eye; this lateral stripe can be traced through the eye and around the snout, thickly sprinkling the upper lip with small dots, but not touching the lower lip; the lateral stripe terminates in an irregular spot at base of and between the lobes of the caudal; sides below the lateral line silvery; belly, plain white. The fins are plain except the dorsal and caudal which are dusky but without distinct markings; teeth 4–4; hooked grinding surfaces very narrow.

Following are measurements of a few specimens in mm., the length being taken from snout to base of caudal fin.

Length.	Head.	Depth.	Eye.	Lat. line.	Dorsal.	Anal.
58	15	15—	4	34	8	7
58	15	15—	4	37		
57	15—	14	4	35		
53	13+	15+	3.5	34		
50	12	13.5	3.5	36		
49	12	13	3.5	33		
54	14	14	4—	33		
53	13+	14	4—	35		
51	13	14	3.5	34		
50	14.5	13	3.5	36		

Etheostoma scovellii sp. nov.—Body stout, head large, snout abruptly decurved, back but little elevated, caudal peduncle broad, spinous dorsal low. Body covered with about ten bands, 1½ mm. wide, of a dark purplish cast, olive between; the first, second and fifth

extending over the back. Pectoral and ventral fins plain, spinous dorsal bordered with black, also an imperfect stripe close to back; soft dorsal with two imperfect dark stripes; caudal frequently barred. Mouth horizontal, lower jaw included, maxillary reaching a little back of front of orbit, nearly to edge of pupil. Lateral line incomplete, reaching to about midway of the soft dorsal.

Measurements taken as in specimens described above.

Length. (total)	Head.	Depth.	Lat. line scales.	Dorsal rays.	Anal rays.
33	10	7	64	XII– 9	I–8
33	10	8	64	XII–11	I–8
33	10	7	64	XII–10	I–8
33	10	7	58	XII–11	I–8
33	10	6+	63		
33	10	6	60		
33	10	6+	63		
30	10—	5.5	64		
29	10—	6	62		
30	10	5	63		

—A. J. Woolman, South Bend, Indiana. March, 1892.

Description of a New Mouse from Southern California.—Seventeen specimens of a long-tailed Vesperimus collected at Dulzura, San Diego Co., Cal., belong to a species very different from any hitherto described. In size and general characters they agree closely with *V. eremicus*, but the color is curiously like that of *V. californicus*. The species may be known by the following characters:

Vesperimus fraterculus sp. nov. Size medium, tail decidedly longer than head and body, thinly-haired and without pencil; soles naked; ears rather large and very thinly-haired except at base and along anterior margin.

Adult male and female (♀ No. $\frac{1135}{962}$ collection of G. S. Miller, Jr., Dulzura, San Diego Co., Cal., January 7, 1892. Charles H. Marsh, collection ♂ No. $\frac{1311}{1044}$ same locality and collector, January 15, 1892); fur everywhere, except in region of mouth, slaty plumbeous at base; ventral surface dirty yellowish-white, becoming purer on throat and chin; a distinct fulvous pectoral spot; sides with a clear fulvous stripe extending from region of eyes to base of tail, under which the stripes of the two sides meet; this fulvous area almost entirely without black-tipped hairs and sharply defined against the color of the

belly, but shading insensibly into that of the back; dorsally yellowish wood-brown, becoming grayish between the ears and over the head and muzzle, everywhere much intermixed with black-tipped hairs, which produce a decided blackish shade throughout the region from shoulders to base of tail and well down over the sides; a narrow dusky ring around eye; tail brownish, slightly paler ventrally, without distinct line of demarkation; whiskers reaching about to shoulders, mixed dark-brown and silvery gray; dorsum of manus and pes white; color of sides extending about to wrists and ankles, which latter are dusky in front.

Measurements taken from the fresh specimens by the collector:

No.	Sex.	Date.	Length.	Tail vertebræ.	Hind foot.	Ear from notch.
$\frac{1217}{1044}$	♂	Jan. 15, '92	185	113	20	18[1]
$\frac{1093}{924}$	♂	Nov. 23, '91	185	102	20	16
$\frac{1096}{927}$	♂	Nov. 28, '91	167	90	20	16
$\frac{1097}{928}$	♂	Dec. 1, '91	200	118	22	18
$\frac{1099}{930}$	♂	Dec. 10, '91	170	90	18	15
$\frac{1132}{956}$	♂	Dec. 26, '91	173	100	20	16
$\frac{1133}{960}$	♂	Jan. 6, '92	150	78	20	15
$\frac{1134}{961}$	♂	Jan. 7, '92	180	103	20	18
$\frac{1136}{963}$	♂	Jan. 8, '92	182	102	20	15
$\frac{1093}{926}$	♀	Nov. 21, '91	188	105	20	16
$\frac{1098}{929}$	♀	Dec. 8, '91	200	113	22	16
$\frac{1135}{962}$	♀	Jan. 7, '92	192	110	20	15[1]
$\frac{1137}{964}$	♀	Jan. 12, '92	185	105	20	—

It will be seen that *Vesperimus fraterculus* agrees very closely in size with *V. eremicus*.[2] The very much darker color of the former will, however, serve to distinguish the two species at a glance.

The series show but little individual variation in color. The coloring of the dorsal surface is remarkably constant, the variation among the adults being practically confined to the amount of shading produced by the black-tipped hairs. They are tolerably evenly distributed and do not tend to form a dark dorsal streak. Three specimens younger than the rest are grayer, but have the fulvous lateral stripe nearly as well developed as the adults. The dirty yellowish white

[1] Type.

[2] See table of measurements given by Dr. C. Hart Merriam, North American Fauna, No. 3, 63.

tinge on the belly is more pronounced in some specimens than in others, and in most there is a tendency for the fur in the region of the anus and genital organs to become pure white. The fulvous pectoral spot is absent in two specimens, and in the others varies from a mere trace to an irregular stripe 25 mm. long and about one third as broad in the widest part. The dusky mark at the ankle is conspicuous in some individuals and nearly absent in others.

The skull of *Vesperimus fraterculus* resembles so closely that of *V. eremicus* that I can find no character by which to distinguish them. The number of specimens of *eremicus* at my disposal is, however, too limited to furnish satisfactory data. As compared with skulls of *V. americanus*, those of *V. fraterculus* average shorter, with brain case of about equal width and rather flatter. The nasals end in an obtuse angle about 1 mm. short of the premaxillaries. They are narrower than in *americanus*. The incisive foramina extend about to first third of anterior molar. The articular process of the mandible is shorter, and the coronoid occupies a more posterior position. The posterior upper molar is relatively smaller than in *americanus*. The following are some cranial measurements of seven specimens of *V. fraterculus*.

Number	$\frac{927}{1096}$	$\frac{930}{1099}$	$\frac{959}{1132}$	$\frac{960}{1133}$	$\frac{929}{1098}$	$\frac{962}{1135}$	$\frac{964}{1137}$
Sex	♂	♂	♂	♂	♀	♀	♀
Basilar length	21.4	19	19.8	19	21	20.6	20.8
Basilar length of Hensel	19	17	17.6	16.4	18.8	18	18.4
Zygomatic breadth	12.6	12	11.8	11.4	—	12	12.6
Interorbital constriction	4	4	4	3.8	4	3.8	3.6
Greatest length of nasals	9.6	8.6	8.4	8.2	9	8.6	8.4
Incisor to molar (alveolæ)	6	5.2	5.4	5.4	6	5.8	6
Incisor to postpalatal notch	10.2	8.2	8.8	9	9.2	9.8	9.2
Height of crown from inferior lip of foramen magnum	7.6	7	7	7	7	6.8	7.4
Length of upper molar series along crowns	3.8	3.8	3.6	3.6	3.4	3.6	3.6
Length of mandible, exclusive of incisors	13.2	11.5	12.6	12.4	13	13	13.2
Length of lower molar series along crowns	4	3.8	3.8	3.8	3.8	3.8	3.6

—Gerrit S. Miller, Jr., Cambridge, Mass. February, 1892.

Zoological News.—A list of a single day's dredging at Port Jackson, N. S. Wales, shows 106 mollusca and sixty-one general invertebrata exclusive of mollusca. Among the crustacea was that rare and interesting species, *Dromia sculpta* Haswell. The specimens obtained enabled Mr. Thomas Whitelegge to settle the question regarding the identity of *Cryptodromia nodulifera* Henderson, described in vol. xxvii. of the Challenger Report with *Dromia sculpta* Haswell. He sees no valid reason why they should be regarded as distinct. (Records Aust. Mus, vol. i., No. 4.) —The Entomostracans recently collected in Russia and Siberia by M. Charles Rabot include nineteen species of Copepods and twenty-seven Cladocera. Although none of them are new to science they are of interest since they are the first reported from that region; and also they afford another proof of the wide geographical distribution of European species. (Bull. Soc. Zool. 1891.) —A new species of Tortricidæ, *Palæobia longistriata*, from N. S. Wales has been described by J. H. Durrant. This species agrees in nervation and structure with the typical forms, but can hardly be said to have the apex of the forewings produced. (Proceeds. Linn. Soc., N. S. W., vol. vi.)

EMBRYOLOGY.[1]

Anatomy of a Human Embryo.[2]—Dr. F. Mall has made a very complete study of the anatomy of an embryo of 7 mm. having about 27 somites and an age closely determined as twenty-six days.

The embryo was cut into 351 transverse sections and every other one of these drawn upon wax plates 2 mm. thick. The wax sections were kept in normal relative position in a plaster mould while the various internal organs were gradually dissected out.

In this way a complete model of the internal organs, as solid bodies seen by removing the overlying tissues from one side of the body, was obtained and subsequently reproduced in a colored lithograph.

A most striking and instructive demonstration of the anatomy of the embryo at this early period is thus represented in Plate 30. The brain and medullary tube, spinal ganglia and auditory vesicle, digestive tract with its branchial pouches, bronchi, pancreas, liver and cloaca together with the Wolffian bodies and ducts, the venous and the arterial parts of the heart and vascular trunks are all represented as solid objects seen in perspective and in a distinguishing color for each system.

The body cavity was studied separately from permanent metal casts made by first casting the hollowed out space in the wax model with Wood's metal, then making a plaster cast of this and finally filling the plaster cast with solder. In this way is shown the origin of the lesser peritoneal cavity as a right diverticulum, near the stomach, communicating with the main cœlom by a constriction that remains as the foramen of Winslow. This becomes of considerable interest from the comparative study made by the author in a preceding number of the same journal, for it is there shown that the single right diverticulum of higher mammals is found in some lower ones and the chick, along with a left diverticulum that early disappears. In some reptiles again both right and left diverticula remain in the adult though even here the right is larger. The ichthyopsida appear to have neither of those diverticula.

Thyreoglossal Tract and the Hyoid.[3]—From the study of sections of a human embryo of 16 mm. Prof. His is led to bring his

[1]This department is edited by Prof. E. A. Andrews, Johns Hopkins University.

[2]Journal of Morphology, 1891, 17 pps. 2 Pls.

[3]Archiv. f. Anat. Phys. 1891, 6 pps.

views regarding the connection of the median *anlage* of the thyroid with the cæcal foramen of the tongue into harmony with the anatomical facts revealed by A. Streckeisen. In this embryo the hyoid comes into intimate contact with the epithelial connection of cæcal foramen and median thyroid and is thus well placed for the formation of those inclusions of gland-tubes within the hyoid described by Streckeisen. Incidentally the study of another embryo of 9·1 mm. leads the author to infer that this median *anlage* may aid in the formation of the lateral thyroids.

Origin of Spinal Ganglia in Man.[1]—Study of a human embryo of 2·5 mm. leads Dr. M. V. Lenhossék to the following conclusions: The medullary plate is at first a median thickening of ectoblast with no thin central region to give it a bilateral or double character. The material for the formation of spinal ganglia first appears as a strand of rounded ectoblast cells, not segmented, along each side of the medullary plate. As the medullary plate closes these two strands unite to form a wedge-shaped mass appearing as cross section as the keystone of the closed medullary tube. Though thus closely united with the tube these spinal ganglian cells grow out again and allow the tube to close a second time without their aid. In this outgrowth the first segmentation appears, the outgrowth being greater in the mesoblastic somite regions, hence the spinal ganglia are from this first appearance intervertebral in position. Later stages are not given, but with the aid of sections of chick and of Siredon the author extends the above view to all vertebrates, explaining away the difficulties offered by certain observations of others; harmonizing the ideas of His and Balfour and in general results agreeing with Beard.

Somites of Human Embryos.[2]—From the embryo mentioned in the last notice and three others of 4·25, 4·5 and 10·2 mm. and with the aid of a comparative study of some lower vertebrates, J. Köllmann obtains facts and explanations of facts that form an interesting contribution to the subject of metamerism in higher vertebrates, though the evidence presented is not all of as convincing a character as might be desired. The chief points may be briefly outlined as follows:

The myotomes (protovertebræ) have at first a cavity, myocœl, which is subsequently filled by an ingrowth of the inner wall. The

[1] Archiv. f. Anat. Phys., 1891, 24 pps. 1 Pl.

[2] Archiv. f. Anat. Phys., 1891, 44 pps., 2 Pls.

inner wall splits open and the ingrowth of cells passes out and ventral to the medulla as the sclerotome or *anlage* of the vertebra. The split becomes the intervertebral cleft or foramen. As the myotome gives rise directly to the sclerotome there is no secondary segmentation of the vertebral column, but rather a proximal dislocation of each sclerotome by the length of half a myotome. After this skeletegenous material has left the myotome its walls give rise to muscles; the inner wall first, forming the dorsal part of the lateral musculature; the outer wall, in man, growing ventrally to furnish muscles for the ventral body wall, digestive tract and also the limbs. The muscles in the limbs are formed from several myotomes, are representations of several metameres, moreover all the segmentation seen in the ventral region and in the limbs is not formed from the lateral plate, but in the above outgrowth into them of parts of the axial myotomes. These muscle buds growing into the limb surround the axial *anlage* of the future skeleton.

Sections of the embryo of 2·5 mm. with 13 somites, show a marked modification of the ectoblast near the intermediate cell mass, becoming a cellular ingrowth posteriorly in older embryos. This is regarded by the author as undoubtedly an ectodermal component of the Wolffian duct.

ENTOMOLOGY.[1]

Descriptions of New North American Bees.—The following species of *Halictus* have the head and thorax and sometimes the abdomen, greenish or bluish, the surface of mesothorax minutely roughened, except in 5, and with a distinct punctuation, the hind spur with few long teeth; and are arranged according to size, beginning with the largest. The following synopsis may aid in separating them:

Mesothorax coarsely reticulated on the sides;	
Head greenish, thorax bluish, legs dark,	1. *reticulatus.*
Head and thorax bluish, legs mostly yellow,	2. *hartii.*
Mesothorax punctured, not reticulated;	
Head, thorax and abdomen greenish;	
Pubescence of abdomen yellowish, thin, not concealing surface,	3. *floridanus.*

[1]Edited by Prof. C. M. Weed, Hanover, N. H.

Pubescence of abdomen white, dense, concealing surface except of 1st and 2d segments, 4. *pruinosus.*
Head greenish, thorax hardly metallic, shining, face very broad between mandibles, 5. *cephalicus.*
Head and thorax greenish, abdomen black or brown, sometimes with a bronzen reflection;
Two submarginal cells, 10. *anomalus.*
Face rounded, clypeus not strongly produced;
Disc of metathorax without enclosure, 6. *obscurus.*
Disc of metathorax bordered by a raised line;
Pale greenish, very sparsely punctured, 9. *apopkensis.*
More bluish, not very sparsely punctured, 8. *illinoensis.*
Face long, clypeus strongly produced;
Wings and nervures dusky, 7. *ashmeadii.*
Wings and nervures whitish, 11. *longiceps.*

1. **Halictus reticulatus.** ♀—Head and thorax bluish, the abdomen black, clothed with thin pale fulvous pubescence; face broad, rounded, clypeus not produced; disc of mesothorax sparsely punctured, on the sides coarsely reticulated; metathorax with a sharp truncation bordered by a salient rim; the disc with a rugose enclosure which is triangular, more or less truncate at edge of declivity, the enclosure bare, elsewhere the metathorax clothed with long, thin pubescence; wings fusco-hyaline, more dusky at tips, nervures and tegulæ testaceous; legs black, knees, anterior and middle tibiæ more or less posterior tibiæ entirely and tarsi testaceous; abdomen shining, impunctate base of second and third segments each with a patch of appressed pale pubescence on the sides. Length 7 mm.

Florida: three ♀ specimens taken at Inverness, Citrus Co., Feb. 12 and 14, on flowers of *Prunus umbellata.*

This species is distinguished from the following by its less coarse sculpturing, its more perfectly defined metathoracic enclosure, paler legs, darker wings, etc. Both are distinguished from all other metallic *Halictus* known to me by their coarsely reticulated mesothorax.

2. **Halictus hartii.** ♀—Black, the head greenish, the thorax bluish, clothed with thin whitish pubescence; face broad, clypeus somewhat produced, punctures dense above antennæ, elsewhere sparse, vertex shining; mesothorax with coarse sparse punctures forming coarse reticulations on the sides; metathorax with abrupt truncation bordered by a sharp rim; the disc very rugous, with enclosure imper-

fectly defined, but appearing triangular, truncate or semicircular; wings fusco-hyaline, second submarginal cell narrow, nervures fuscous, tegulæ black; abdomen shining, impunctate. Length 7 mm.

One ♀ specimen, taken in Southern Illinois, Aug. 11, by Mr. C. A. Hart.

3. Halictus floridanus. ♀.—Head, thorax and abdomen greenish, the legs blackish; above the pubescence is thin and yellowish, beneath it is white; face long, flat, clypeus strongly produced, mandibles rufo-piceus at tips; disc of mesothorax not shining, minutely roughened, closely and finely punctured; metathorax truncate, the disc covered with fine wrinkles; wings hyaline, nervures and tegulæ testaceous; knees and apical joints of tarsi testaceous; abdomen of same color as thorax, more shining, minutely punctured; clothed with pale pubescence except on discs of first and second segments, the pubescence not concealing the surface, as in the next species; apical margins of segments testaceous, which with the pubescence sometimes gives the abdomen a subfasciate appearance, reminding one of *H. fasciatus* Length 6–7 mm.

Florida: 16 ♀ specimens, taken at Inverness from March 7 to 20, on flowers of *Lupinus villosus* and *Ceanothus microphyllus*. It visits the former for stray pollen, the latter for honey and pollen.

It resembles *H. fasciatus* Nyl. (= *H. flavipes* Thompson) in color and in the sculpture of the disc of metathorax. It is smaller, has a longer, flatter face, the mesothorax more finely roughened and therefore less shining, the abdomen without regular apical fasciæ, etc.

4. Halictus pruinosus. ♀.—Head, thorax and abdomen green, clothed with a thin hoary pubescence; face long, finely punctured, clypeus strongly produced; mandibles, except base, ferruginous, flagellum testaceous beneath; mesothorax minutely roughened, not shining, closely and rather finely punctured; disc of metathorax with irregular rugæ running from base but hardly reaching apex, which is smooth and somewhat elevated; wings whitish, hyaline, nervures whitish, tegulæ pale testaceous; abdomen shining, almost impunctate, narrow apical margins of segments pale testaceous, all the segments except discs of first and second, densely clothed with hoary pubescence. Length 6 mm.

♂.—Closely resembles the female; clypeus strongly produced, disc of metathorax rougher, abdomen also green, more punctured, shining, with thin pubescence; apex of clypeus, labrum, flagellum beneath,

nervures, tegulæ, knees, tibiæ at tips, and tarsi pale testaceous; one specimen shows the nervures as pale as in female, the other has them much darker. Length 6 mm.

Illinois: 9 ♀, 2 ♂ specimens, taken from May 19 to June 25, on flowers of *Oxalis corniculata*, *Melilotus alba*, *Scutellaria parvula* and *Tradescantia virginica*.

In size, color of pubescence and wings this species closely resembles *H. albipenuis*. It is distinguished from that species by its face, which is longer, a little more sparsely punctured, its mesothorax more closely and finely punctured, its metathorax less rugous, its abdomen green and not depressed.

5. Halictus cephalicus. ♀.—Smooth and shining, clothed with very thin pale pubescence, head greenish, thorax blue-black, abdomen brownish; head very large, wider than thorax, strongly produced behind eyes, especially the cheeks below; face subquadrate, finely and sparsely punctured; clypeus transverse, truncate; labrum broad, short, pointed; mandibles long, ferruginous, except base; flagellum testaceous beneath towards tip; prothorax forming a lateral dentiform angle, mesothorax blue-black, shining, sparsely and minutely punctured, appearing impunctate; metathorax black, strongly retracted and strongly sloping, so that it presents a very small truncation, the latter heart-shaped, being divided above by a fissure; wings hyaline, nervures and stigma testaceous; legs blackish, knees, tibiæ at tips and tarsi testaceous; abdomen brownish, impunctate, apical margins of segments testaceous, the segments clothed with thin, pale pubescence. Length 6 mm.

♂.—Resembles the female, but does not show the peculiar head characters, clypeus somewhat produced, metathorax rougher above and bordered on each side by a ridge. Length 5 mm.

Illinois: 1 ♀, 2 ♂ specimens, taken July 15 at a bank which was filled with nests of *H. zephyrus*. The sexes were taken in copula.

This species may be easily distinguished by the shape of its head, which is much like that of the ♀ of *H. ligatus* Say (=*armaticeps* Cress., *texanus* Cress., *ornatipes* Cress., *capitosus* Sm.).

6. Halictus obscurus. ♀.—Form rather slender, head and thorax dark blue-green, abdomen black, clothed with thin pale pubescence; face round, the clypeus somewhat produced; mesothorax minutely roughened but shining, sparsely punctured, the pubescence thin; metathorax rather narrow, strongly retracted, truncate, with several

raised lines proceeding from base, but not reaching truncation; wings hyaline, nervures and stigma testaceous; legs black, apical joints of tarsi testaceous; abdomen black, shining, clothed with thin pale pubescence. Length 5–6 mm.

Illinois: 22 ♀ specimens, taken from April 28 to May 12, in woods, on flowers of *Ranunculus septentrionalis, Isophyrum biternatum, Chærophyllum procumbeus, Osmorrhiza longistylis, Polemonium reptans,* and *Ellisia nyctelæa.*

This species closely resembles *H. confusus,* but is distinguished by its more slender form, its darker color, its clypeus more produced, its mesothorax more shining, more sparsely punctured, and more thinly pubescent, its metathorax longer, less rugose, more truncate, its abdomen darker, more thinly pubescent, etc.

7. Halictus ashmeadii. ♀—Head and thorax greenish, the abdomen bronzen, clothed with thin, pale pubescence; face long, the clypeus strongly produced; disc of mesothorax minutely roughened, not shining, densely and finely punctured on the sides; metathorax with a small truncation, the disc finely roughened, more striate laterally; wings subfuscous, nervures dull testaceous, tegulæ testaceous; abdomen rounded, depressed, shining bronzen, clothed with thin pubescence; legs blackish, knees and tarsi testaceous. Length 4–5 mm.

Florida: 12 ♀ specimens, taken from Feb. 12 to March 19, on flowers of *Viola lanceolata, Ceanothus microphyllus, Prunus umbellata* and *Ilysanthes grandiflora.*

This species resembles *H. longiceps* (No. 11), but is distinguished from that species by its larger size, shorter head, more densely punctured mesothorax, darker wings and nervures, etc. Dedicated to the distinguished hymenopterist, Mr. W. H. Ashmead.

8. Halictus illinoensis. ♀—Face broad, rounded, clypeus hardly produced; mesothorax shining, minutely roughened, sparsely punctured, with thin, pale pubescence; metathorax not strongly retracted, the disc shining, with several longitudinal raised lines; in the middle is a raised line not reaching the truncation; from the tip of this there is a raised line which runs out on either side and forms a superior lateral angle of the truncation, thence it runs forward, joining two or three lines on the extreme side of the disc; wings hyaline, nervures and tegulæ pale testaceous; legs more or less testaceous, especially the knees and tarsi; abdomen shining, brownish, apical margins of segments testaceous, the segments clothed with thin, pale pubescence. Length 5 mm.

Illinois: 2 ♀ specimens, taken Aug. 12, on flowers of *Malva rotundifolia* and *Sium cicutæfolium*.

It closely resembles *H. confusus*, but differs by its smaller size, enclosed metathorax, etc.

9. Halictus apopkensis. ♀ —Head and thorax greenish, abdomen brownish; face broad, rounded, finely and rather sparsely punctured, clypeus hardly produced; mesothorax minutely roughened, somewhat shining, minutely and very sparsely punctured, appearing impunctate, with very thin whitish pubescence; metathorax shining, sculptured as in preceding; wings whitish hyaline, nervures and stigma very pale, tegulæ testaceous; knees and tarsi testaceous; abdomen shining, clothed with thin, pale pubescence, apical margins of segments testaceous. Length 5 mm.

Florida: 3 ♀ specimens, taken Feb. 12 and 16, on flowers of *Prunus umbellata* and *Viola lanceolata*. Readily distinguished from the preceding by its paler wings and more sparse punctuation.

10. Halictus anomalus. ♀ —Head and thorax dull greenish; face rounded, clypeus produced; disc of mesothorax finely roughened, hardly shining, bare, or nearly so, with sparse, rather coarse, shallow punctures; metathorax shining, not strongly retracted, the disc with elevated lines not reaching apex; wings hyaline, with only two submarginal cells, nervures and tegulæ testaceous; abdomen brownish, shining, impunctate, with thin, pale pubescence. Length 4–5 mm.

Illinois: 2 ♀ specimens, taken May 19, on flowers of *Hypoxis erecta*.

11. Halictus longiceps. ♀ —Head as long as thorax, strongly produced behind eyes, clypeus strongly produced, eyes long; mesothorax minutely roughened, hardly shining, finely and sparsely punctured, clothed with thin whitish pubescence; metathorax narrow, disc finely roughened; wings whitish, hyaline, nervures and tegulæ pale testaceous, third submarginal cell subobsolete; abdomen depressed, shining, clothed with pale pubescence. Length 4–5 mm.

Florida: 4 ♀ specimens, taken Feb. 10 to 18, on flowers of *Prunus umbellata*.

Andrena mandibularis. ♂ —Black, clothed with long, thin, pale pubescence; head broader than thorax, strongly produced behind eyes; face broad, subquadrate, clypeus flat, shining, thinly pubescent,

with sparse, fine punctures; mandibles long, slender, ferruginous at tip, the extreme base beneath bearing a conspicuous tooth-like spine; mesothorax finely roughened, opaque, impunctate; enclosure of metathorax finely roughened, merely marked by absence of pubescence; wings long, hyaline, nervures honey-yellow, tegulæ dull testaceous; legs slender, black, apical points of tarsi testaceous; abdomen shining, impunctate, with very thin fasciæ. Length 8 mm.

Illinois: 2 ♂ specimens, taken on flowers of *Salix cordata*, April 17.

Calliopsis parvus. ♀—Small, black, opaque, densely and finely punctured, almost destitute of pubescence; mandibles at tips honey-yellow; wings fusco-hyaline, a little dusky at tip, marginal cell obliquely truncate, second submarginal narrowed nearly one-half toward marginal, receiving first recurrent about one-third from base, and the second at or near apex; nervures fuscous, tegulæ testaceous; disc of metathorax with a triangular space bearing fine longitudinal rugæ; abdomen with segments depressed to the middle, the apex with thin, pale pubescence. Length 5 mm.

♂.—Lower corner of face, clypeus, spot on labrum and base of mandibles yellow; flagellum beneath, knees and basal joints of anterior and middle tarsi testaceous. Length 5 mm.

Illinois: 3 ♀, 1 ♂, taken May 28, the female collecting pollen of *Monarda bradburiana*.

Melissodes palustris. ♂—Black, shining, reflecting greenish or purplish, especially on abdomen; head, thorax, and 1st segment of abdomen above with thin, rather pale fulvous pubescence, beneath the pubescence is paler; clypeus yellow, labrum varying from entirely black to entirely pale yellow; antennæ reaching to middle of 2d segment, flagellum fulvous beneath, except the last one or two joints, mandibles sometimes with a yellow spot at tips; disc of mesothorax thinly pubescent, closely punctured, except posteriorly; wings fusco-hyaline, nervures fuscous, tegulæ testaceous; legs black, tibiæ at tips and tarsi ferruginous, claws, except base, black; bases of 2d and 3d and following segments of abdomen densely and finely punctured, opaque, elsewhere shining and sparsely punctured, segments 2–5 each with a broad fascia of appressed white pubescence; that of 2d is basal, only reaching apical margin on each extreme side, that of 3d is on the middle, also reaching apex on each side; the 4th and 5th segments have broad, interrupted apical fasciæ, connected on the mid-

dle of the 4th by an arcuate line, sometimes also similarly connected on 5th, 6th segment with a triangular tooth on each side, 7th with a more slender tooth. Length 12–14 mm.

Illinois: 10 ♂ specimens, taken July 5, 9, and Aug. 5, on flowers of *Dianthera americana* and *Pontederia cordata.*—*Charles Robertson*, Carlinville, Illinois.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History.—February 3d.—The following papers were read: Dr. J. Eliot Wolff, The Geology of the Crazy Mountains, Montana; Mr. Walter G. Chase, The Scenery, Glaciers and Indians of Alaska.

February 17th.—The following paper was read: Prof. George L. Goodale, Illustrations of Vegetation in Ceylon.

March 2d.—The following papers were read: Prof. W. G. Farlow, Notes on collections of Cryptogams from the Higher Mountains of New England; Prof. G. Frederick Wright, Invasion of Eastern England by Norwegian Glaciers; Additional Evidence Concerning Human Remains Under the Sonora Table Mountains, California.

March 16th.—The following paper was read: Dr. J. Walter Fewkes, The Moki Snake Dance.—SAMUEL HENSHAW, *Secretary pro tempore.*

The Biological Society of Washington.—February 20th.—The principal paper of the evening was Factors in the Distribution of Animal Life as Illustrated by Marine Forms, by W. H. Dall. The following communications were read: Mr. F. A. Lucas, On *Charcharodon mortoni*; Mr. J. N. Rose, The Flora of the Galapagos Islands; Mr. John M. Holzinger, On the Identity of *Asclepias stenophylla* Gray, and *Acerates auriculata* Engelm.

March 5th.—The principal paper of the evening was Conditions Affecting the Distribution of Plants in North America, by Fred. V. Coville. The following communications were made: Mr. Charles Hallock, The Physiology of a Pocoson; Mr. Vernon Bailey, The Homes of Our Mammals; Mr. Theo. Holm, The Flora of Nova Zembla.—FREDERIC A. LUCAS, *Secretary.*

The American Physiological Society, which is an offshoot of the Society of Naturalists, held its annual meeting on Dec. 29th at Philadelphia. Some routine business was transacted, and the follow-

ing officers elected for the ensuing year: President, Prof. John G. Curtis, of the College of Physicians and Surgeons, New York city; Secretary, H. Newell Martin, Johns Hopkins University; Council, H. P. Bowditch, Harvard College; R. H. Crittenden, Yale College; W. H. Howell, University of Michigan.

SCIENTIFIC NEWS.

The fourth annual report of the Marine Biological Laboratory at Wood's Holl is issued. From it we glean the following statistics and other items. The laboratory last year accommodated 67 workers, divided as follows: Investigators occupying private rooms, 17; investigators receiving instruction, 9; students, 44. In the report of 1890 a debt of $5,000 was an unpleasant item. This has all been paid, but the laboratory still needs money, not only for an enlargement of the building but for a permanent endowment. In its four years the laboratory has turned out a goodly amount of work, no less than 31 papers being catalogued as issued or in press which are based upon researches carried on at Wood's Holl. The library has been increased by purchase and gift, and 21 periodicals are regularly subscribed for. In his report as director Dr. Whitman indicates the lines for growth. He would have facilities afforded for research in what for want of a better name he calls biological physiology. He would have the laboratory kept open the whole year with a corps of paid investigators, and he would have a more intimate connection between the laboratory and the colleges and universities which patronize it.

The circulars for the coming summer will probably be issued before this is read, but any wishing information about the laboratory can obtain it by addressing either Prof. C. O. Whitman, Clark University, Worcester, Mass., or Prof. H. C. Bumpus, Brown University, Providence, R. I.

Recent Deaths.—Dr. Ernst von Brücke the physiologist, of Vienna, January 7th, 1892, in his 72nd year; he was a pupil of Johannes Müller. Louis Francois Héron-Royer, at Amboise, Dec. 15, 1891, aged 56 years; he was best known for his studies on the life histories of the Batrachia. Prof. Armand de Quatrefages, the well known Zoologist and Anthropologist, in Paris, January 12, 1892, aged 81 years. Prof. Edward Brandt, of St. Petersburg, Dec. 12 (N. S.), 1891; he was best known for his works on the embryology and nervous system of the insects. Sir William Macleay, in Sydney, N. S. W., Dec. 7, 1891, aged 71 years; he was the most prominent person in the development of biology in Australia.

A large treatise on Zoology is announced as in progress. Of publisher, extent, etc. nothing has yet appeared. The list of authors is as

follows: Dr. Fabre-Domergue, Paris: Rhizopoda, Ciliata, Suctoria; Prof. Moniez, Lille: Sporozoa, Trematodes, Cestodes; Prof. Künstler, Bordeaux: Flagellata, Anthozoa; Prof. Vosmaer, Utrecht: Sponges; Prof. Lang, Zürich: Hydrozoa, Siphonophores, Acalephs, Ctenophores, Turbellaria; Prof. E. Van Beneden, Liege: Dicyemida, Tunicates; Prof. Justin, Liege: Orthonectida, Amphioxus, Cyclostomes; M. de Guerne, Paris: Rotifera and Gastrotricha; Prof. Roule, Toulouse, Archiannelida, Sternaspidæ, Phoronis; Prof. de Nabais, Bordeaux: Hirudinei; Prof. Yung, Geneva: Annelida; Prof. Cuénot, Nancy: Bryozoa, Echinoderms; Prof. Joubin, Rennes: Brachipods, Nemertines, Chætognaths; Prof. Pelseneer, Ghent: Molluscs; Prof. Köhler, Lyons, Nemathelminthis, Acanthocephali, Enteropneusti; Prof. Vayssiere, Marseilles: Protracheata, Myriapods, Hexapods; Prof. Barrois, Lille: Arachnida; Prof Giard, Paris: Crustacea; Dr. Dollo, Brussels: Fishes, Batrachia, Reptiles, Birds; Prof. Weber, Amsterdam: Mammals; Dr. Denniker, Paris: Primates.

Dr. Joubin, Palais Universitaire, Rennes, France, wishes to obtain all the brachiopods in alcohol possible, so as to study their anatomy. Exotic specimens are especially desirable.

The "Agassiz Club," with a membership limited by its constitution to fifteen, has recently been started in Corvallis, O.

Regular meetings once a month; extra meetings can be called by vote. It is conducted on much the same principles that characterize the Zoological Club at the Museum of Comparative Zoology, at Cambridge, the rooms being open an hour or two before presentation of regular paper, for perusal of current scientific journals or magazines. The Club, however, is not alone a zoological club. Interesting papers have been read on the following: Electricity, Plant Parasites, The Problem of the Soaring Bird, Some Points in the Anatomy of the Brain.

The President of the Club is Prof. G. W. Shaw; Vice-President, Prof. G. A. Covell; Secretary and Treasurer, Prof. Moses Craig.

The Oriental History Society of Altenburg will celebrate in the Autumn of 1892 the seventy-fifth anniversary of its establishment, and will take advantage of this opportunity to pay tribute to three of the honorary members of the Society by the erection of a simple, worthy monument in the capitol city of Altenburg. They are Chris-

tian Ludwig Brehm, his son, Alfred Brehm, and Prof. Schlegel, who died at Leiden.

The researches of these three men in zoology, and particularly in ornithology, are known, not only among their associates, but throughout the world, and demonstrate that their memory should be honored.

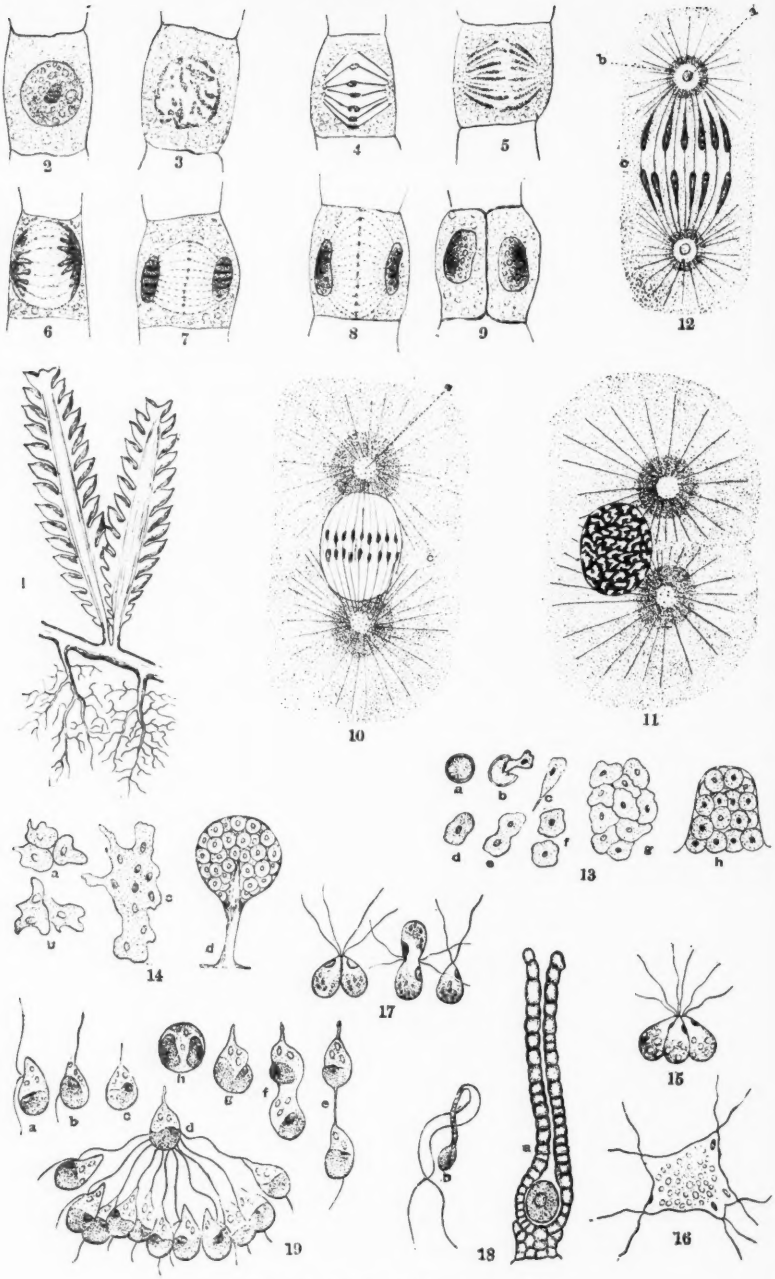
The undersigned committee, under the patronage of His Highness Prince Moritz of Saxe-Altenburg, also an honorary member of the Society, solicits contributions from the friends of these eminent scientists for the purpose of aiding in the erection of the proposed memorial.

It is respectfully requested that contributions be forwarded to Hugo Koehler, Privy-councillor of Commerce, in Altenburg, and that inquiries and letters be addressed to Dr. Koepert, in Altenburg.

The Committee: Prince Moritz of Saxe-Altenburg; Prof. Dr. Blasius, Braunschweig; Dir. Prof. Flemming, Altenburg; Major A. v. Homeyer, Greifswald; Hugo Koehler, Privy-councillor of Commerce, Altenburg; Dr. Koepert, Altenburg; Prof. Dr. Liebe, Privy-councillor, Gera; Prof. Dr. Pilling, Altenburg; Dr. Reichenow, Berlin; Dr. Rothe, Privy-councillor of Medicine, Altenburg; Chevalier von Tschusi zu Schmidhoffen, Hallein; Dr. Voretzsch, Altenburg; Dr. Leverkuhn, Munich.

Altenburg, December, 1891.

PLATE XI.



Fecundation and Development.